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POWER

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Appreciating the Engineer

"A MAN does not invite his gardener to dinner" is a remark that was made in a discussion of the relation of the engine room to the office, of the engineer to the Big Boss.

The remark found favor in a coterie to whom the term "engineer" suggests plug tobacco and cylinder oil, soot, sweat and greasy overalls, uncouth manners and banal conversation.

Notwithstanding all that modern civilization owes to engineering and the engineers this popular visualization persists.

And something of this estimation of the man in charge of the power plant lingers to affect the views of some executives toward that department.

But the growing importance and complexity of the power department, with its multiplicity of new services and the modern avenues for improvement in effectiveness and efficiency, have developed a new type of department head.

The power-plant engineer who has kept up with this progress, who sees wastes that could be eliminated, savings that could be made, services that could be improved, does not expect to dine or play golf with the president—though there are some who do—but would like to discuss the affairs of his department with an intelligently appreciative executive if he knew how to make the approach.

Some executives find these men, draw them out and profit by their experience and knowledge.

Talking with such an engineer recently, a representative of *Power* asked him just what part of the job his company expected him to do.

"Everything mechanical," he answered. "The other day the Old Man asked me if I couldn't fix his watch."

Some engineers can sell their capabilities better than others. One who had made a striking improvement in the mill where he was employed, was hired by another manufacturer in the same line. Arriving at the new place, he found the attitude of the office much that described in the beginning

The next time the president who had engaged him came to town, the engineer asked him whether he had been hired to run the engine or to manage the power plant.

As a result of his insistence upon authority commensurate with what was expected of him, his status was established with the local management as responsible head of the power department with full control of its personnel and access to its accounts. The last I knew he was in charge of the power services of all the several mills of the company and the president's chief adviser in such matters

F. R. Low

POWER *Stands for . . .*

1. **Making Power When It Should Be Made**
2. **Buying Power When It Should Be Bought**
3. **Cheaper Power Through Modern Equipment**
4. **Easier Financing of Equipment Purchases**
5. **Better Use of Byproduct Heat and Power**
6. **Operating Methods That Save Money**
7. **Less Waste in Transmission and Application**

The Value of Periodic Inspection

WHAT goes on inside a machine? In a general way, engineers know; but variations from normal behavior often are not evident until the condition has gone beyond easy correction and a shutdown for repair is necessary. And sometimes the condition becomes so serious before it is noticed that an accident or a bad failure is experienced.

This being an unavoidable state of affairs, plans must be laid to minimize its consequences. Periodic, thorough inspection of all power equipment should be as much a part of the plant routine as sleep is part of a man's activities. Time between inspections should be so regulated as to anticipate the occurrence of serious troubles, and the schedule set for this work should be rigidly adhered to. To open a turbine and go over it at short intervals, may make a lot of work for the operating staff; but it frequently saves the cost of an extensive reblading job and the losses resulting from reduced plant capacity.

Obsolescence Is the Common Lot

A CERTAIN large manufacturing plant has recently won wide commendation because of its pioneering in production methods. From a rather backward, old-fashioned factory, it has, in the last three or four years, advanced to the position of leading exponent, in its field, of modern, scientific practice. To the casual glance the whole organization seems imbued with the spirit of progress.

But closer inspection reveals one place where this spirit does not function. Nothing in the power plant is less than twenty years old. No advantage at all has been taken of the forward strides in power generation that have been made in the last few years. Steam, electricity, in fact all power services, are costing this plant much more than would be the case if modern equipment and methods were used.

The management is aware of this condition. But the claim is made that the equipment is still good for years of service and that the plant cannot afford to write off the capital invested in it.

Here is a peculiar situation that is, unfortunately, too often found. This management seems to think that obsolescence applies only to manufacturing equipment. Not for one instant would the handicap of obsolete production equipment be tolerated. In contrast, the power equipment must run until it falls apart, regardless of the savings in manufacturing cost that could be made if cheaper power were procured through the agency of modern developments.

Faced with these facts, the power engineer must become a missionary and labor ceaselessly in the vineyard. He must neglect no opportunity to preach the sermon of improved power equipment. He must convince his management, and keep them convinced, of the fact that a dollar saved in power cost goes just as far toward decreasing the production costs of the factory as a dollar saved anywhere else; and that obsolescence, far from being a unique property of production machinery, is the common lot of all equipment.

Accelerated Experience

IT IS perhaps true, as often claimed by classical scholars, that the citizens of Athens, in the golden days of ancient Greece, were as intelligent a group as the world has ever seen. Yet this renowned body of intellectuals, with the ability and the leisure to think, added but little to the world's knowledge of the forces of nature. Mechanical experience—most of the contact with natural phenomena—was left to slaves. Keenness of intellect can never replace experience, and so the Athenian citizens made little direct contribution to the practical arts or the understanding of natural laws.

The human mind as an instrument may not have improved since the time of Plato, but its productivity in the fields of science and technology has been enormously multiplied, because men have learned that thinking, to get anywhere, must go hand in hand with experience, and that experience itself can be accelerated a hundred-fold by the scientific method.

In the course of a man's life many things will happen to him, or at least come within the range of his vision. From these he will profit. This undirected experience is sure, but slow and costly. On it chiefly has been based the development of the older industries: steel, textiles, tanning and gray-iron founding, to mention a few.

In contrast to hit-or-miss experience is accelerated experience, which is merely another name for scientific and industrial research. The results of research, as seen in some of our newer industries, are truly astonishing. In less than a decade the development of rayon has disturbed the balance of the age-old textile industry. That young David, artificial leather, has dealt a body blow to the tanning Goliath, who thought too well of unguided experience. Welding, with scientific vision, made swift advances, while the gray-iron founders slept undisturbed —another example of a few decades of accelerated

experience outweighing centuries of natural, hit-or-miss progress.

The time has already come when far-seeing investors are no longer content to examine records of earnings and balance sheets. They ask embarrassing questions about research activities. Plant and earnings mean little to them if the whole fabric of the business may be upset overnight by scientifically equipped competitors.

Today, as always, industry is based on experience, but only where that experience is scientifically accelerated can there be hope of success in the competition of the future.

Operating Methods That Save Money

THE method of operating a power plant is as subject to improvement by scientific study as is the design of the major items of equipment. Too often hunch and prejudice, rather than disinterested study, determine what operating methods shall be used. This, however, is not always the case. The Detroit Edison Company, to take one example, is noted for its willingness to decide operating problems on an engineering basis.

For this reason particular interest attaches to the article in this issue in which the combustion engineer of the Beacon Street heating plant, Detroit, reports the results of an impartial comparison of the results obtained with hand operation on the one hand and automatic boiler control on the other. In this case automatic control had to compete, not with the ordinary sloppy hand control, but with the highly intelligent variety. In spite of this, automatic control showed a definite advantage over hand control as is indicated in the summing up at the end of the article.

The importance of this article as a field test of automatic control is equaled by its value as an object lesson in the scientific method. If all plants would apply engineering analysis to problems of operation, much money now wasted would be saved to increase profits.

Fuel Conferences

THIS appears to be an open season for fuel conferences. One was held last month under the auspices of the A.S.M.E. at Cleveland; the second, or London Fuels Conference, is reported in this issue; and a third, of International scope, will take place next month in Pittsburgh. It is indicative at least of the importance which engineers, with good reason, attach to the subject of fuels.

To the casual observer these meetings coming so close together may savor of duplication. The programs, however, represent different approaches to the problem. That at Cleveland dealt largely with operating practices at home, while that at London gave an insight into some of the fuel problems of other nations. The Pittsburgh Conference will deal more particularly with what is being done along the lines of research, especially in the processing of coal.

Certain high spots loom out of the London Conference. It is apparent that many of the other nations are compelled to use lower grades of coal requiring pretreatment, such as cleaning, drying or briquetting. Low-temperature carbonization has made headway in Great Britain to the extent of there now being sixteen such plants in actual operation. These appear to be operating successfully from a technical viewpoint, although not yet having attained the desired commercial efficiency. Furthermore, it is interesting to learn that the Soviet government is definitely committed to pulverized coal for their power program, which deals with the use of a wide range of low-grade coals from lignite to anthracite culm.

Throughout the meetings at London much interest was manifested on every hand in the coming Pittsburgh Conference. Many of the delegates to the London Conference are anticipating attending at Pittsburgh. If we in America are able there to show to our foreign guests even a small proportion of the many courtesies extended to the American delegates in Great Britain, we shall have contributed our part to the growth of better national understanding and good will.

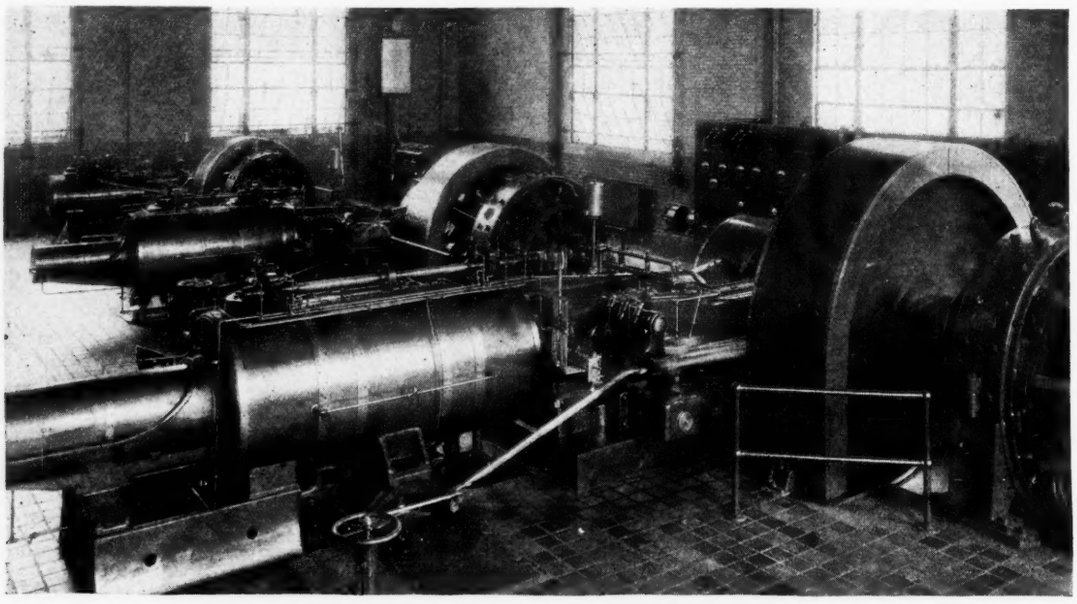
The Diesel Engine "Goes Up"

THEY told Hiram Maxim that his idea of building a practical flying machine was idiotic. Yet he built one and it flew—powered with a steam engine! In like manner the Wright brothers battled against public pessimism in order to lay the foundations for modern flying. At almost every step in aviation's progress the loudest voices have been raised in skepticism, often in derision.

But the spirit of the times has changed. Engineering achievement has been so rapid and so far reaching that it has become the habit to wait awhile before criticizing a new thing. The reactionary is no longer in the majority.

Into this generally receptive attitude of the public mind there now comes still another startling achievement —a Diesel engine has been built that is light enough for use in aviation. Announcement has been made that successful flight tests have been carried out on such a machine—tests that have convinced engineers of the entire feasibility of using the Diesel principle in aviation work. When we think back a little to the huge slow-turning oil engines which heretofore have exemplified the important advantages and economies of the Diesel, it is difficult to see how this giant could have been changed into the swift, featherweight machine which alone is useful to the aviator. Yet the thing has been done. From a hundred pounds per horsepower the weight of the new Diesel has been reduced to no more than three pounds.

A famous scientist once said that the impossible is that which the world has not yet learned to do. Evidently, the world is learning fast.



The engine room contains three uniflows and one emergency gasoline set

MODERN POWER PRACTICE

in a Public Building

AMONG recently completed public buildings having their own power plants is the Essex County Hall of Records, Newark, N. J. Here is a layout especially well adapted to the service demands and embodying some features not ordinarily found in a plant of its size.

When the new building was projected, a careful study was made by the consulting engineers as to the advisability of installing a generating plant or purchasing power. The steam and electric demands are such that during four months of the year both live and exhaust steam are required for the heating and ventilating load, and for another four months the exhaust steam alone is adequate. Hot water is required all year for lavatories and cleaning. All heating is done by direct radiation with a vacuum system, whereas the ventilating air is conditioned and maintained at 68 deg. In offices this air is changed five to six times an hour and in the large public rooms six to ten times. The ventilating system takes twice as much steam as does the direct heating.

Although there was not complete agreement between the figures submitted by the local utility company and those of the consulting engineers, the latter decided, in view of the foregoing steam demands, to put in a generating plant.

The power plant is housed in a separate building at the rear of the Hall of Records and is connected with it by a tunnel. The old County Court House, across the street, is being completely renovated and will also be served by this plant. The maximum combined load will be about 300 kw., while 100 kw. will take care of the night load. This governed the selection of engine sizes.

By installing three units of 100, 200 and 300 kw. respectively, the maximum load can be carried by the largest unit alone or a combination of the other two, and the smallest unit will take care of the night load; or a medium load can be handled by the second unit. Thus considerable flexibility is afforded as well as reserve capacity.

Economy in steam consumption, price and a characteristically flat load curve were largely responsible for the selection of the uniflow type. Incidentally, it may be mentioned that as a guarantee of performance, the engine builder deposited with the county a bond of $15,000 to cover a penalty of $4,000 per pound increase in steam consumption, if after one year's service a test should reveal any loss in economy.

Pulverized coal, combustion control, pneumatic ash disposal, uniflow engines, with gasoline-electric set for emergency service, and full line of instruments found in power plant of Essex County, N. J., Hall of Records.

Instead of providing breakdown service from the street, a gasoline-electric set is provided. In consists of a 150-hp. gasoline engine driving a 75-kw. direct-current generator. This is sufficient capacity to supply the plant auxiliaries, emergency lighting, etc. Inasmuch as outside service is alternating current, and direct current is employed exclusively in the

plant, outside breakdown service would have necessitated a motor-generator set. The fixed charges on such equipment plus the breakdown service charge would have amounted to more than the fixed charges on the gasoline-electric set installed.

Steam is furnished by three 3,000-sq.ft. V-type boilers designed for 200 lb., but operated at 150 lb., the latter pressure showing a better efficiency with the simple, non-condensing uniflow engines installed. The V-type of boiler was chosen partly because of favorable experience with it in other plants of the county and partly because of economy in floor space. When operated at 200 per cent rating, two of these boilers are capable of supplying the steam demands of zero weather. Space has been provided for a fourth boiler, should future steam demands warrant its installation.

It was decided early to install pulverized coal. The guarantees of fineness offered for the ball mills exceeded those of other types. However, because the plant is in the heart of Newark's business section, it was feared that the greater noise inherent with this type might prove objectionable. Finally, an impact unit type of mill was selected because of its relative quietness, less power on light loads and favorable price, together with a reasonably satisfactory degree of pulverization. Although no cinder catchers were installed, and the plant has been operating since last fall, no complaints have been received from adjacent buildings as to deposits of fine ash. The ash content of the coal runs from 6 to 7 per cent.

Coal is brought to the plant in trucks and dumped into an underground hopper through which it passes to the crusher. It is then elevated and distributed by a flight conveyor (see cross-section) to an overhead service bunker having a capacity of 215 tons, or sufficient for twelve to fourteen days in winter. From this bunker chutes lead through the weighing hoppers to each pulverizer as well as to a 400-ton storage vault. It was believed safer to store the coal after crushing, as the finer coal is less likely to catch fire in storage. From the vault coal will be reclaimed by a conveyor feeding the elevator.

Although the weighing hoppers are on the boiler operating floor, the pulverizers, one to each boiler, are in the basement. Each feeds a single flare-type burner. Primary air is drawn through the floor of the furnace and passes into the pulverizer at approximately 100 deg. Secondary air to the burners is first forced under about 2 in. pressure through the furnace side walls, where it is heated between 200 to 300 deg., depending on load conditions. Automatic control is applied to the pulverizer feeder, the secondary air and the furnace draft.

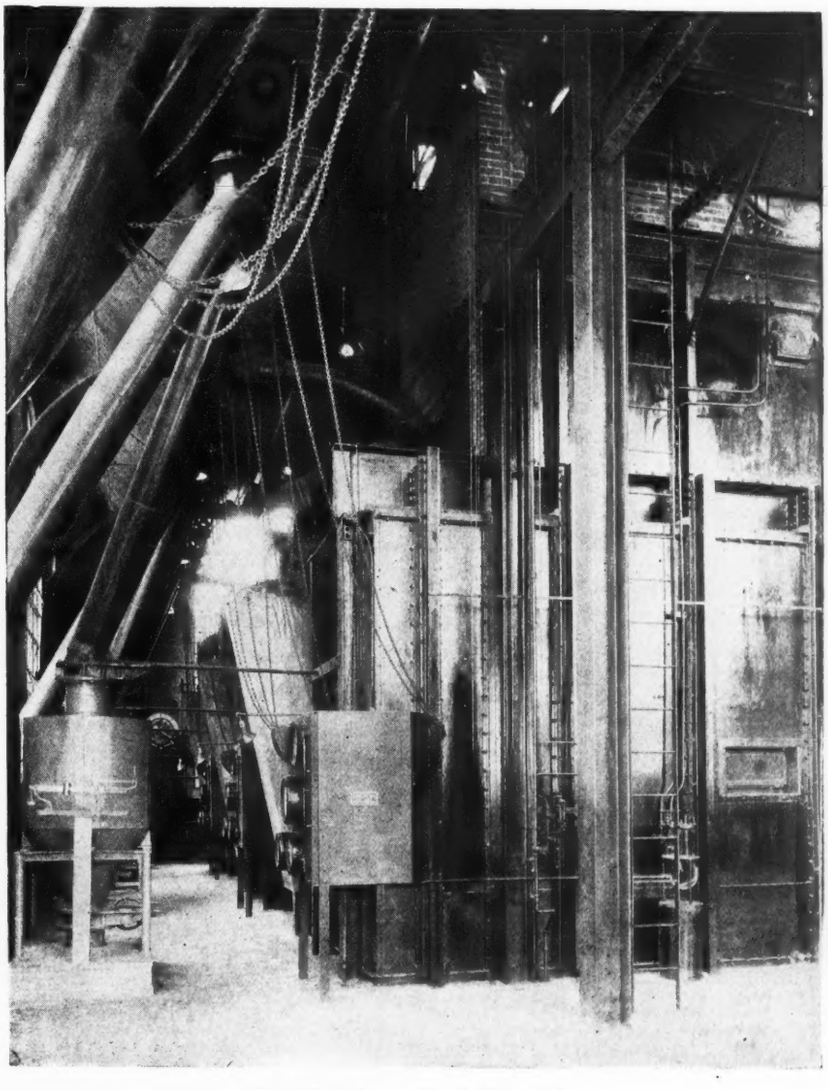
The inside furnace width is only six feet, and it was felt that at the higher ratings the flame impingement would scour the side walls. The long axis of the burner was therefore set longitudinally to the furnace in order to narrow the flame. No erosion of the side walls has taken place, nor have the furnaces been repaired since this plant was placed in service.

The unit pulverizers are direct-driven by 25-hp. 220-volt motors at a constant speed of 1,750 r.p.m. The secondary air fans are direct driven by 7½-hp. 220-volt motors at a variable speed from 400 to 1,100 r.p.m. The combustion control system automatically controls the coal feed to the pulverizers and the secondary air which supports combustion. The uptake damper controller is a separate unit and is controlled by the furnace draft. The entire system functions as one unit and automatically controls combustion in accordance with the load conditions of the plant.

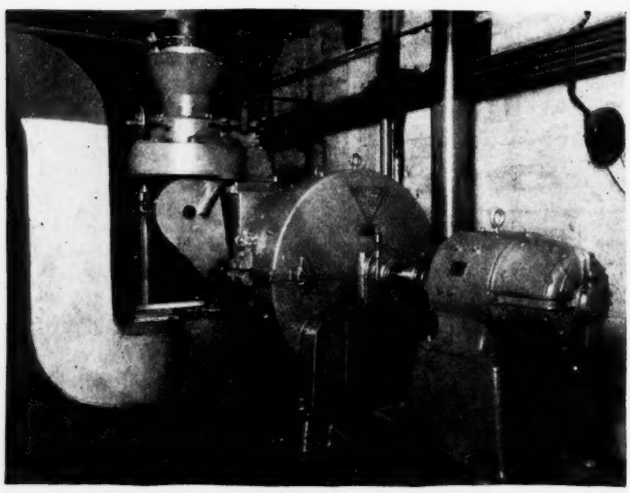
Suitable manual control adjustments must be provided if the correct fuel-air ratio is to be maintained under all conditions of operation. These are conveniently located where the operators can observe the furnace conditions and make such adjustments as are necessary.

Each boiler has a steam gage, a steam-flow meter, a horsepower indicator, a two-point draft gage, CO_2 indicator, a flue-gas recording thermometer and a feed-water regulator.

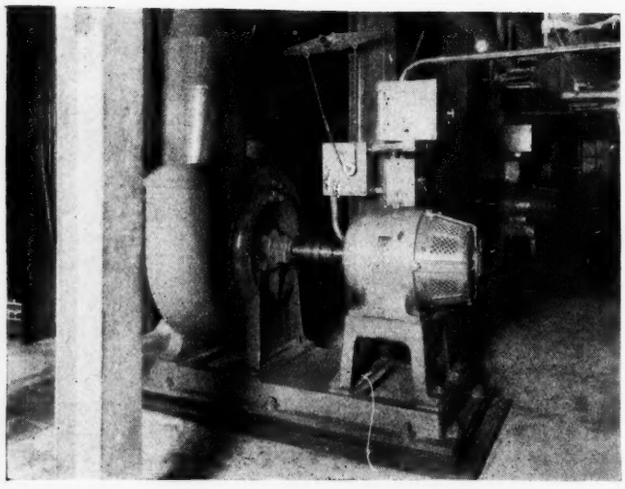
Disposal of ashes is effected by means of a steam-jet



Looking down the boiler aisle



The pulverizers are below the firing floor



Fans which force secondary air through furnace walls

PRINCIPAL EQUIPMENT, ESSEX COUNTY HALL OF RECORDS PLANT

General

Location	Newark, N. J.
Generating capacity	675 kw.
Fuel	Pulverized coal (unit mills)
Steam pressure	150 lb. gage
Superheat	None

Coal and Ash Handling

Yard scales	Meyer Scale Co.
Capacity of concrete coal-storage vault	450 tons
Capacity of overhead bunker	215 tons
Capacity and make of crusher	30-ton Jeffrey
Elevator and flight conveyor	Jeffrey Mfg. Co.
Crusher, elevator and conveyor motors	General Electric Co.
Weighing hoppers	Runyon & Carey design with Meyer scales
Ash handling system	Vacuum Ash & Soot Conveyor Co.
Ash tank	20 tons (Allen-Sherman-Hoff)

Boiler House

Boilers	Three 3,000-sq.ft. Heine V-type
Furnace	Air-cooled
Furnace volume per boiler	1,570 cu.ft.
Furnace walls	Detrick
Economizers	None
Soot blowers	Bayer, 6 per boiler
Three Tracyfiers	Blaw-Knox
Traps for Tracyfiers	Williams Gauge Co.
Observation doors	Vastine
Safety valves	Consolidated
Non-return valves	Foster
Boiler stop valves	Crane
Feed-water regulators	Copes (Northern Equipment Co.)
CO_2 recorders	One Uehling with 3 recording meters
Venturi meter	One, Builders Iron Foundry
Steam-flow meters	Bailey
Draft gages	3 Bailey 2-point
Steam gages	3 Crosby
Flue-gas recorders	3 Bristol
Water gages	Ernst, inclined type
Pulverizers	Three 2,500-lb. Riley Atrita driven by Star Electric motors
Burners	Riley flare type
Secondary air fans	3 Clarage driven by Star motors
Automatic control	One Hagan master regular controlling coal feed to pulverizers and secondary air; also one Hagan controller on each uptake damper
Boiler feed pumps	One steam-driven Worthington; one 4-stage 85 g.p.m. Buffalo centrifugal driven by Star Electric motor
Injector	One Metropolitan
Feed-water heater	One 1,800-hp. Cochrane
Steam feed-pump governor	Foster
Motor-driven feed-pump control	Cutler-Hammer
Stack	One Radial brick, 138 ft. high, 10-ft. base, 7-ft. top (H. R. Heinicke, Inc.)
Ratio stack diameter, at base to furnace volume	1 to 471 cu.ft.

Engine Room

Generating units	One 300-kw., one 200-kw. and one 100-kw. Skinner unaflow and G.E. generator; one 75-kw. Sterling gasoline engine set
Switchboard	Westinghouse with Westinghouse circuit-breakers, Weston voltmeters and ammeters, Sangamo watt-hour meters, Angus-Esterline recording meters and General Electric voltage regulators)

Miscellaneous Power House Equipment

Air compressor	One steam-driven (Westinghouse)
Hot-water pumps	2 motor driven Buffalo
Hot-water heater	1 Whitlock coil pipe type
Blowoff tank	1 steel cylindrical
Receiver-separators	3 Cochrane
Exhaust head	Swartwout
Reducing valves	Foster
Back-pressure valve	1 Cochrane
Steam piping	Reading
Pipe covering	Keasbey-Mattison
Miscellaneous valves	Jenkins
Vacuum apparatus for power house use	Allen & Billmyre Co.

Service Equipment

Ammonia compressor	One 8-ton De La Vergne driven by a Westinghouse motor
Air compressors (temperature control)	Two Johnson (motor-driven)
Elevator air compressors	Two Westinghouse (motor-driven)
Compressor for house tanks	One Ingersoll-Rand driven by a G.E. motor
Ice-water pumps	Two American, driven by Westinghouse motors
House pump	Buffalo, driven by Star motor
Fresh-air fans	Three Buffalo Forge Co.
Air washers	Three Carrier Type A
Washer pumps	Three Buffalo
Ventilating fans	Nine Buffalo Forge driven by Star motors
Vacuum heating pumps	Two "Nash" driven by G.E. motors
Vacuum cleaner	One Spencer

Plant designed by Runyon & Carey, consulting engineers, Newark, N. J.; general on heating, ventilating and power-house work, Shevlin Engineering Co.; subcontractor on electric equipment, Jandous Electric Equipment Co.; supervisor of Essex County plants, H. H. Berg; chief engineer, Peter Dias.

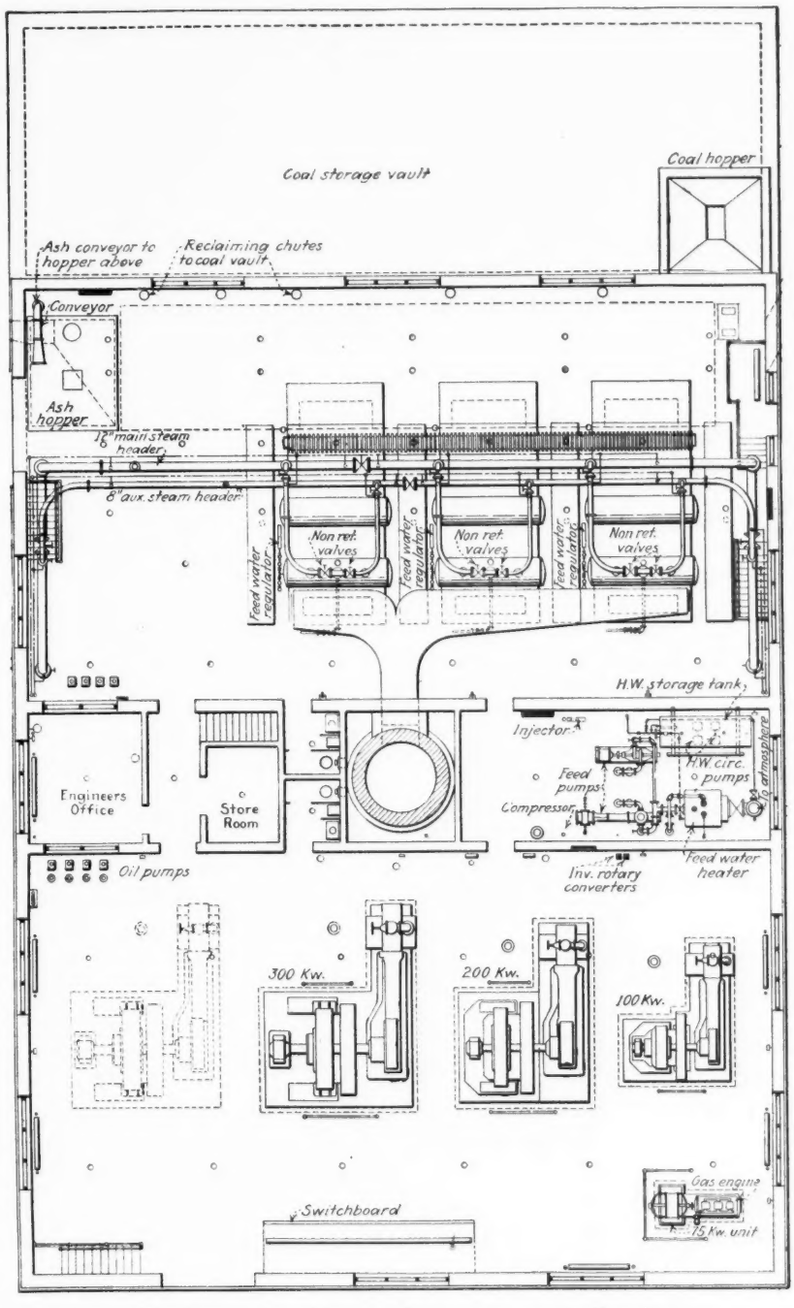
conveyor system discharging into a tank from which they are carted away by trucks. It has been found that the steam dampens the fine dust sufficiently to prevent its being blown about from the trucks. The conveyor pipe of this system is embedded in the basement floor at the rear of the boilers, with an intake at each boiler ashpit. Thus far it has been found advantageous to empty the ashpits daily with the boilers on the line before the peak load. This arrangement proves satisfactory and makes unnecessary the weekly period of cleaning the furnace pits. The ash hopper is emptied about once a month. A flexible boot is also provided over each intake to carry off ash and soot accumulations from the rear boiler passes. This helps greatly in keeping the boiler room clean. When the boilers were first placed in operation, some slagging was noted in the ashpits. It was found, however, that this could be prevented and the ash kept in a light flaky form by having the rear ashpit doors slightly open at all times.

Each boiler is connected through a non-return valve and 6-in. line to a 12-in. steam main. Similarly, a 4-in. connection leads from each boiler to an 8-in. auxiliary steam main. Stop valves are placed so as to permit isolating any boiler or any part of the steam mains.

The air conditioning system, the temperature control system, the eight-ton refrigerating machine and a vacuum cleaning system are in the basement of the Hall of Records. A separate vacuum cleaning system is provided for the power house. At present four passenger and one service elevators are installed and shafts are provided for two more. These elevators have micro drives and automatic air-closing doors.

Everything in the plant is motor-driven, except one feed pump and one air compressor. Generation is at 250 volts with distribution on a three-wire system, the motors employing 250 volts and the lights 115 volts.

The heating system is of the Warren Webster overhead downfeed vacuum-return type, using electrically driven vacuum and boiler-feed pumps for returning the condensation to the boilers and removing the air from the system. The radiators and coils above the basement floor and the unit heaters have sylphon quick-opening supply valves for controlling the admission of steam to the radiators and coils of the unit heaters. Radiators in the basement have double service valves which, besides supplying the radiators, serve as traps for draining the top riser to the radiator. The return ends of all radiators, coils, unit heaters, drips of risers and steam mains are equipped with sylphon traps.



The layout provides ample room around all units

All the exhaust steam from the main engines, etc., passes through a low-pressure oil separator.

The building is equipped throughout with the Johnson system of automatic temperature control. A two-point multiple thermostat inserted in the cold air duct controls the intake damper and inner row of coils. The extreme outside row remains under hand control to assure heat on at all times to prevent the possibility of the air washer apparatus freezing in winter.

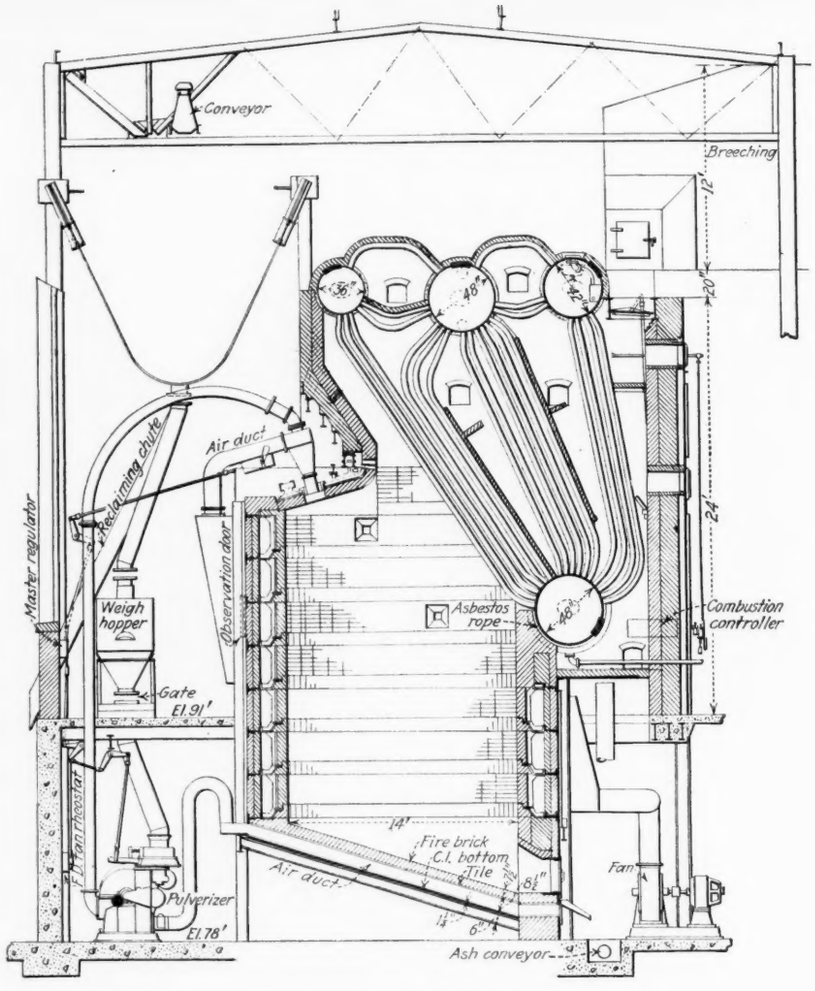
A three-point multiple thermostat inserted in the duct at the discharge side of the fan is adjusted to close one of two sections of heater coils at a certain temperature. If the temperature continues to rise a few degrees, the second section closes off. The third point controls a mixing damper. If the temperature still continues to rise, the cold-air supply portion of the damper opens wide and the hot-air portion closes entirely, allowing unheated washed fresh air to bring down the temperature. Three of these sets are installed.

The foul air is discharged by exhaust fans through

flues having pneumatically controlled dampers. On boards with these pneumatic controls are mounted electric switches to stop the fan motor when the exhaust damper is closed.

In each room throughout the building a small thermostat is connected to a sylphon metal bellows valve attached to the supply end of the radiator. Each thermostat is of the positive action type and will close the valve as soon as the temperature rises about one degree above the set point.

The refrigerating plant consists of one motor-driven ammonia compressor, condensers, evaporation coils, cooler, ice-water pumps and filters. This plant was designed to cool the water for drinking purposes only, and it is equipped with a mercoid temperature control which automatically governs the compressor motor. The compressor operates intermittently instead of continuously, and the raw water is filtered before being cooled. This equipment is designed with sufficient capacity to provide cool drinking water to the Court House as well as the Hall of Records. The plant was placed in service Nov. 7, 1927, and up to the present has given entirely satisfactory operating results as well as having met its designed requirements.



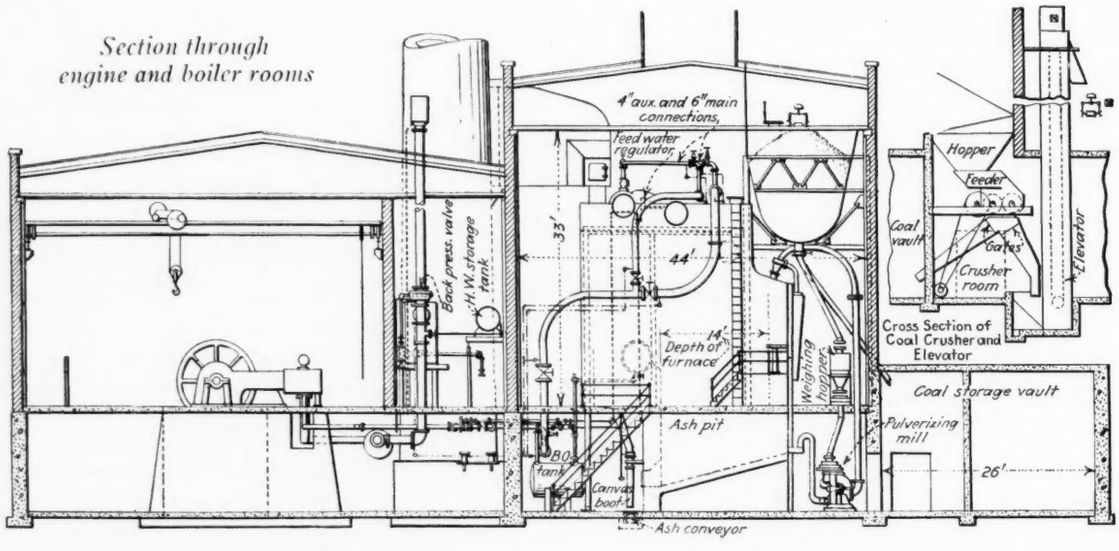
Section through boiler plant

There has been practically no maintenance or repairs, only the scheduled upkeep of the plant equipment, which is the regular routine work for maintaining efficient operation.

The evaporation, furnace and boiler efficiency is good when considering that the boilers are not equipped with super-heaters nor economizers. The evaporation from and at 212 deg. F. runs from 10.59 to 10.92 lb. and the furnace and boiler efficiency from 75 to 78 per cent. This is at ratings from 160 to 170 per cent.

A series of tests was conducted with various grades of coal to establish that best suited to the requirements, taking into consideration its price delivered. This resulted in the selection of a coal having the following analysis: Volatile matter, 28.66 per cent; fixed carbon, 67 per cent; sulphur, 1.03 per cent; fusing temperature of ash, 2,800 deg. F.; ash, 11 per cent; B.t.u., 14,000.

Section through engine and boiler rooms



This coal, being soft, insures minimum wear of the pulverizing elements; also the high fusing temperature avoids slagging.

The present plant personnel had no previous experience with pulverized coal, having been transferred largely from the hand-fired plant of the old Court House. The chief engineer, however, has a background of over twenty years' experience, a considerable portion of which was spent in the marine field in the navy and the merchant marine as chief engineer of passenger liners.

These men quickly applied themselves and in a relatively short time were able to understand and master the burning of pulverized fuel. The morale of the operating force is excellent and the plant speaks for itself in cleanliness and efficient operation.

The power plant was designed by Runyon & Carey, consulting engineers, of Newark. The Shevlin Engineering Company did the heating, ventilating and powerhouse work, and the Jandous Electric Company the electrical work. The plant is operated under the supervision of H. H. Berg, plant superintendent for Essex County. Peter Dias is chief engineer in immediate charge of the power plant and the various services supplied by it. Acknowledgment is made to these men for assistance in preparation of the description.

Letters From An Oil-Engine Operator

On the Spare Part Question

Dear Ed: I got your last letter and was sorry to hear that you lost that crank bearing, but to tell the truth, you need to be booted. I always told you and I tell you again to stop using filter cloths that are rotten and full of holes. It serves you right if you had to work all night filtering a new box. Remembering the way you are always trying to keep down expense, it's a wonder to me that you had one on hand. I bet you throw away the filter cloths the next time they are full of holes, and I also bet that in about a year you will be up to your old tricks of trying to save a few pennies. If you get away with it, you will pat yourself on the back and think how smart you are, until you burn out another bearing.

If I did not know you so well, I would not say these things, but you know that you tried cheap oil once and almost lost your job on account of it. You never would have a spare part on hand until after you had an exhaust valve burn out on you and had to wait a day with your plant shut down while a messenger brought a new one from the factory.

You have mashed your toe by dropping a connecting rod out of a rotten sling, when you should have been using a chain hoist and honest rope.

I am laying the law down to you, Ed, because every so often you need it. Remember when you told me about getting your lubricating oil fouled with water by trying to get a few months' more service out of the packing on your piston-cooling telescopic tubes? I do. You saved five dollars on packing and lost three barrels of oil.

You have a cooling tower installed now, but you simply had to get your cylinder jackets and heads, to say nothing of the pistons, filled with scale four times before you would spend the money to have a tower put in; this in spite of the fact that the water you were using was costing you more per year than the price of the tower.

It would not be so bad if you could not get what you want, but I know your boss too well to lay the blame on him. You can get anything you want by asking for it, but you put off ordering until you cannot get along any longer and then cry that you never thought you were going to need it.

I am telling you straight that if you did not have a good boss you would lose your job, because you are losing money for him with your methods. Your watch engineers ask you to get things you know you should have, but you will not get them. They don't dare tell you so, because you are the chief, but I dare to tell you because I know you as the one time tightest engineer that ever went to sea. We are not at sea now, and I am no longer your chief, but I'll keep right on telling you until you change your ways.

Don't write me any more hard-luck stories about having to work all night and miss your smoker. I say it serves you right. Yours for a little common sense,

—E. O. Leseid.

Lubricating Worm Gears

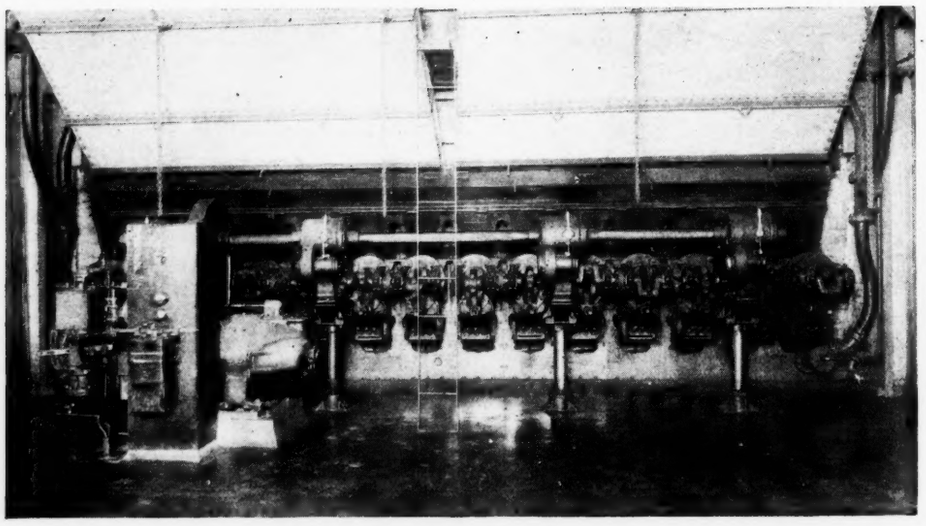
THE essential problem in operating a worm gear is to lubricate the worm and gear so that the minimum starting and running torques will be developed irrespective of operating temperatures or other conditions.

As a general rule it is conceded that the lubricant for such service should be approximately of the same consistency as a medium steam cylinder oil, with a viscosity in the neighborhood of 120 to 150 sec. Saybolt, at 210 deg. F. The chief requirement is sufficient body to resist the relatively high pressures exerted at the points of contact of the gear teeth and worm, especially when starting under heavy loads.

Various lubricants are available for such service ranging from the straight mineral, steam-refined cylinder oil stocks, down to certain light grease compounds or mixtures of cylinder oils with vegetable or fish oil. Each lubricant may involve its own particular problems according to the manner in which it has been refined or compounded, or the temperature of the gear case.

For example, with a lubricant containing a fixed oil compound such as fish oil, a high degree of acidity may be developed, to result in rapid corrosion of the metallic gear surfaces or the ball thrust bearings. If a gear grease is used, unless the compounding has been carefully carried out, there may be a tendency toward separation of the oil and soap constituents, with the result that the gear and worm will be subject to rapid wear, especially where the petroleum constituent is a light oil without sufficient body to insure prevention of metallic contact between the teeth.

Where castor oil is included in a worm-gear lubricant, it is important to understand that the lubricating ability of this oil may be affected materially by the process of compounding. Ordinarily, castor oil is not soluble in petroleum oil; to bring about a mixture certain processing is necessary or a third oil serves the purpose of a blending reagent. But such treatment may affect the constitution of the castor oil and render it decidedly susceptible to chemical change. In some instances a lubricant so compounded may become so sluggish at low temperatures as to give rise to abnormally high starting and running torques, especially where the mechanism is located at the top of a shaft and exposed to appreciably low atmospheric temperatures.—*Lubrication.*



One of the stokers serving boiler No. 2 with motor controller and automatic speed regulator in foreground

AUTOMATIC BOILER CONTROL
Compared with
MANUAL OPERATION

By Arthur S. Griswold
Combustion Engineer, Beacon Street Heating Plant
Detroit Edison Company

As MAY be recalled from previous publicity, the boilers at the Beacon Street heating plant are of the Stirling W type with 41,500 sq.ft. of heating surface. They are not equipped with superheaters, economizers or air preheaters. Each boiler has two fourteen-retort underfeed stokers which discharge their refuse into a common ashpit. A double-voltage, direct-current motor, with a speed range of 240–2,100 r.p.m., is used to drive each stoker. Forced draft and induced draft are supplied by direct-connected, remote-controlled, direct-current-motor-driven fans. Each unit is designed to deliver 400,000 lb. of dry steam per hour at 150 lb. pressure. At present three boilers are installed, but plans are in preparation for a fourth unit to be ready for service by September, 1929.

In this plant the purpose of the boiler control is to regulate the air and coal going to the furnace in such a manner that the proper quantities for the most efficient combustion will be supplied continuously regardless of the boiler load. As now installed, the control receives its actuating impulses from the steam pressure at the main header. By means of a steam pressure element a loading pressure is built up on a "supermaster." This loading pressure is relayed to the individual boiler masters. Slight variations in steam pressure that result from boiler load changes thus vary the loading on the boiler masters and so affect the regulators that the steam pressure is brought back to normal.

Each boiler is equipped with one boiler master, two stoker-speed regulators, two air-to-furnace regulators and one furnace-pressure regulator. The boiler master relays the loadings which it receives from the supermaster to the individual regulators. Convenient adjustments are available on the masters so that the loading on the individual regulators can be changed if necessary.

The installation is unusual in that it is applied to boilers that are fired by two stokers. This necessitated the installation of a speed regulator for each stoker and a plenum chamber divided into two compartments, one under each stoker. Regulators control louver dampers which admit the required amount of air to each section. These four regulators provide definite means of regulating the air and coal to each stoker.

The regulators for each boiler are so adjusted that with all loading pressures equal, the correct quantities of air and coal are supplied to the furnace. These adjustments, made by trial and error, definitely establish the best conditions under which the stoker normally can operate. If the fireman observes that either side of the fire is not as it should be, correction can be made by adjustment of the loading pressure to one regulator. When this section becomes normal, he changes the loading back to the normal position. Operation is then resumed with predetermined quantities of air and fuel going to the furnace. Adjustments on the boiler master to correct irregularities in the burning of the fuel are necessary about once or twice an hour at normal rates of steaming. At low steaming rates the adjustments are less frequent.

Furnace pressure is controlled by regulating the opening of the boiler outlet dampers. The regulator operating these dampers is independent of all the other regulators and has no connection to the boiler master.

Speeds of the forced-draft and induced-draft fans are controlled manually through field rheostats mounted on the boiler gage board. With draft gages and signal lights

to show when a greater or less speed is necessary, this system has worked out satisfactorily.

In operating the control, numerous problems have been met and satisfactory results have been produced. However, there are several points that have not been solved completely. The first and probably the most striking characteristic demonstrated by the control is its ability to maintain a constant steam pressure. Although steam-pressure regulation had not been considered a troublesome problem with the old method of operation, the control maintains the pressure so well that it is now considered a valuable feature. This constant steam pressure has helped materially the operation of the steam-driven auxiliaries and is a great assistance in operating the plant because it frees the firemen of responsibility and is a stabilizing influence in the entire procedure of plant operation.

With the control operating, the division of the load between boilers has been as good as can be expected. The steaming rates and the daily output of the several boilers are always nearly equal. While but two boilers have been operated at a time, as good results can be expected with any number.

Actual combustion control has presented by far the most interesting problems. Experience has shown that the amount of excess air required depends upon the boiler load. At low steaming rates a large excess is required to prevent the fire from becoming heavy and unmanageable. At medium rates of steaming less excess is required, but with high boiler loads a greater excess is necessary to avoid excessive furnace temperatures. The CO_2 content of the stack gases is an inverse function of the amount of excess air supplied to the furnace for combustion and is used as a guide in firing the boilers. The curve of Fig. 3 shows the amount of CO_2 over the entire range of boiler loads for which the control originally was adjusted. The mechanism is so constructed that any desired variation of CO_2 with boiler load, within certain limits, can be obtained.

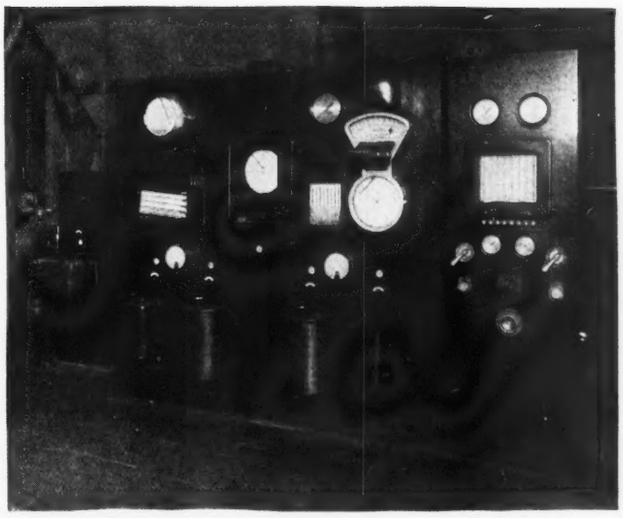


Fig. 2—Boiler master and control board for boiler No. 2

A study has been in progress at the Beacon Street heating plant of the Detroit Edison Company to determine the value of combustion control, as it can be applied in this company's plants. Smoot equipment was selected for the purposes of this study. Although a high standard of manual operation had been maintained, the verdict is in favor of automatic control.

During the last winter the plant was operated with and without the control in alternate two-week periods. Records were kept of boiler loads and CO_2 in the stack gases during these periods and the average results computed by grouping the boiler loads. For example, all boiler loads between 101,000 and 120,000 lb. per hour were considered as of one group. For every hour possible the averages of all loads in this group and of the CO_2 for these loads were found. Curve No. 1, Fig. 4, shows the average CO_2 during periods when the control was in operation and curve No. 2 for periods when the boilers were fired without the aid of the control equipment. These curves show that the CO_2 in the stack gases is not greatly different with the control operating than without it.

The difference at the higher steaming rates can be attributed partly, if not entirely, to difficulties in measuring the air supply. These difficulties are believed to have been caused by faulty air ducts rather than by the control equipment. Reference to both charts will show that the average CO_2 is not as high as that for which the control is adjusted. The expected CO_2 is based on results obtained in comparatively short runs under exceptionally good conditions, so that it is only natural that it should be higher than the results from long periods of operation. Besides, the plant is in a downtown district where smoke prevention is necessary, so that occasionally the excess air must be increased to prevent smoke and thus decrease considerably the CO_2 average for such periods.

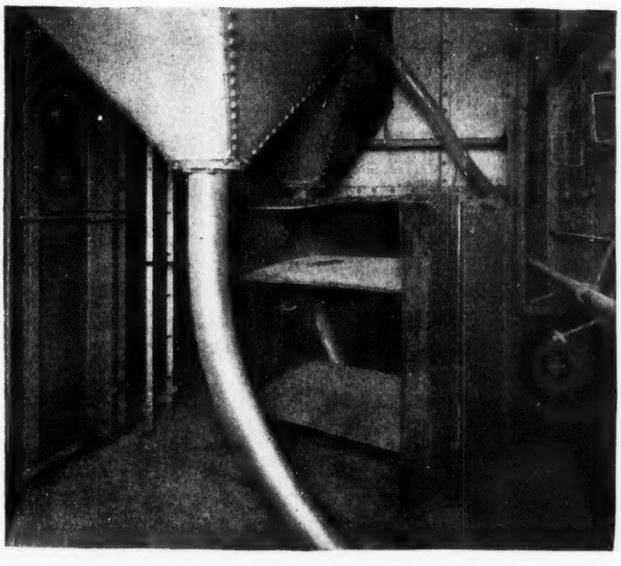


Fig. 1—Dampers that regulate air to one section of the plenum chamber

Except for increasing loads the control has been quite successful in maintaining the proper ratios of fuel and air, although an occasional adjustment is necessary to correct a tendency of a fire to become either light or heavy on one of the two stokers. The two regulators keep the stoker speeds closely equal and the quantities of air supplied to either stoker seem to be just about the same. With ordinary loads the door dividing the two

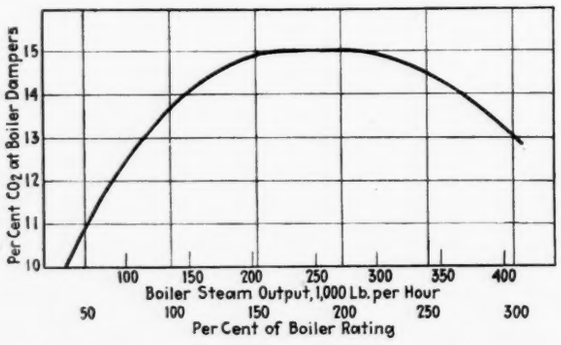


Fig. 3—CO_2 at boiler dampers for which the control was adjusted

sections of the plenum chamber has been kept open and both fires burn evenly without any need for unusual adjustment.

Above 225 per cent of rating, where the coal-burning rate is about 50 lb. per sq.ft. of grate area per hour, the operation of the control has not been entirely successful. Eddy currents in the air ducts have produced a peculiar effect and acted in such a way that a large excess of air is supplied to the furnace. This condition will be corrected by installing vanes to prevent the eddy currents. Holes in the fire develop rapidly if the furnace is not carefully watched. In spite of this it is quite probable that the control will maintain a satisfactory ratio of fuel and air when conditions are so corrected that a reasonable measure of the air going to the furnace at high steaming rates can be secured.

Means provided for decreasing the ratio of fuel to air at high ratings to give the drooping CO_2 shown in the curve of Fig. 3, have not been used because of the difficulties caused by the eddy currents. It is possible that such provision will not be necessary, since, with a fixed ratio of coal and air to the furnace, there is a natural tendency for the percentage of CO_2 to decrease at high steaming rates.

Of the several things that occasionally happen to affect the operation of the control, probably the one that occurs most often is the change in amount of coal per ram stroke. The quantity of coal supplied is considered a direct function of the stoker speed. The regulators move the stoker-motor controllers to control this speed. Observations have shown that the quantity of coal fed per ram stroke varies noticeably. With the two stokers running at exactly the same speed more coal may be supplied to one than the other and thus require adjustment of the fuel supply. Any changes that occur in the quality and character of the coal burned also have their effects.

In an attempt to determine what increase in efficiency, if any, could be credited to the control, the plant was operated during alternate periods of about two weeks each, with and without the control, during the last winter, and weekly computations of the boiler efficiency were made. This comparison was rather severe inasmuch as the plant organization and the firing methods using hand control were of a high order.

The results appear to indicate that the gain due to automatic control, if there was a gain, was masked by the ordinary fluctuations in efficiency from other causes. The firemen at this plant have had many years' experience and are considered quite capable of taking advantage of any means of improving their work. It is probable that any benefit which the fireman found while the control was operating, he readily applied to his manual control. It is interesting to note that boiler efficiencies above 80 per cent were maintained throughout the last heating season.

The control relieves the fireman of watching the pilot gage and gives him time to use greater care in inspecting his fires. The control also makes it possible for him to take care of more boilers in an efficient manner. He has before him at all times means of knowing when the most nearly correct quantities of air and coal are being supplied to the furnace. Any deviation from these amounts is deliberately made and is indicated by some device or indicator that will be out of its normal position. Whenever a change in load is called for, the control changes both the coal and the air supply. It thus supplies the elements of combustion at a rate conforming more closely to requirements than is done in manual firing.

Mechanically, the control has given but little trouble. Occasional cleaning and a few minor adjustments have been all that has been necessary. All regulators have ample power to do their work and can be adjusted easily to prevent overtravel and hunting.

Results obtained in this experiment with automatic combustion control lead to the following conclusions applying to this particular plant.

1. There is little gain in combustion efficiency over the best results obtainable from hand control, but it is not so difficult to maintain good efficiency over a long period.

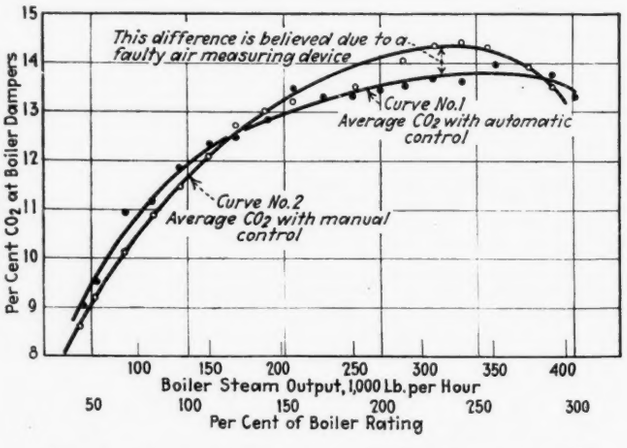


Fig. 4—Average CO_2 at the boiler dampers with and without automatic control

2. Automatic regulation of the steam pressure is a distinct advantage in a large boiler room.

3. Automatic regulation of the overfire pressure provided by the combustion control is desirable.

4. The automatic control will not maintain the proper fuel to air ratios indefinitely without minor hand adjustments. Such adjustments occasionally will be necessary when operating at a constant steaming rate and will be imperative with rapidly increasing or decreasing loads.

In and Around Power Plants

Fig. 1 (above)—Storing coal with a tractor and scraper

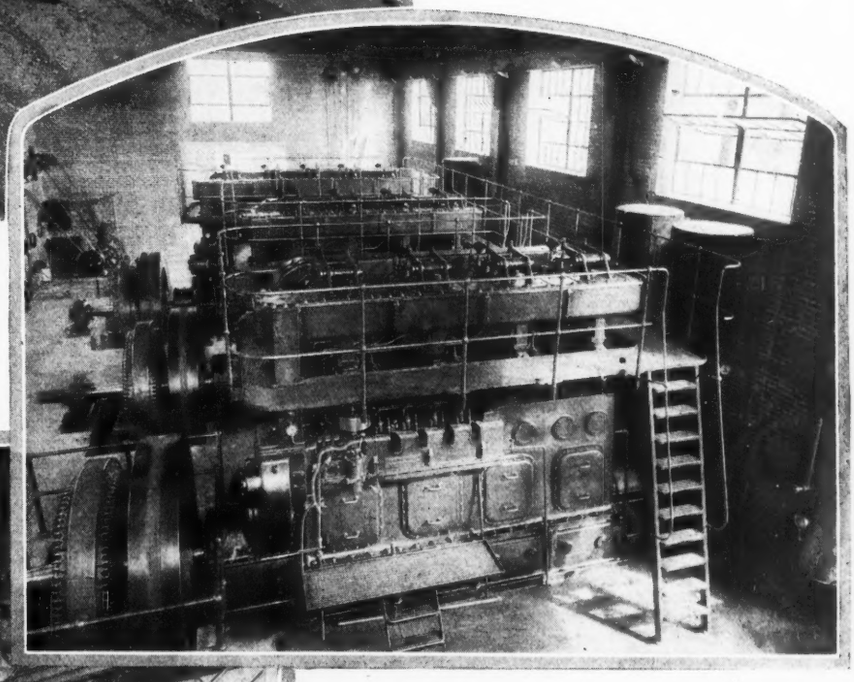


Fig. 2 (below)—Three De La Vergne Diesels at Westminister, Ind.

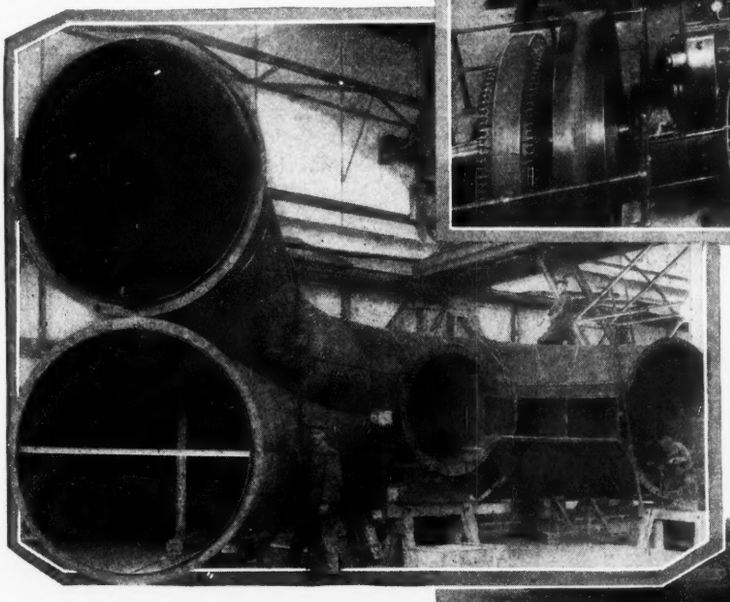


Fig. 3 (left)—Y-intake for hydraulic turbine, Muenchen, Bavaria

Fig. 4 (right)—One of the small hydro-electric developments of Porto Rico

POWER PLANT EFFICIENCY

Increased by Application of

CHEMISTRY

By Capt. H. C. Dinger

Officer in Charge,
Engineering Experiment Station,
United States Naval Academy,
Annapolis, Md.

IN NEW power plants the theoretical possibilities are being very nearly approached on the basis of utilizing the full range of temperature, reheating, regenerative feed heating, air heating, etc., so that there is not so much left to gain. However, there is another field that can be developed through which some increase in efficiency can be secured and by which operating expenses can be reduced. This field covers various means of protection of parts by which the need for repair, renewal, expensive overhauling, and cleaning operations may be lessened. Considerable progress in this field has been made; but, by more effective use of the industrial chemist and metallurgist, and of research to discover practical preventives to guard against damage and deterioration, it may be possible to make still further savings in the cost of generating electricity. In other words, if the power plant employs scientific methods of applying preventives and preservatives, its cost of maintenance may be lessened to a considerable extent.

One of the chief causes of expense lies in the condition of the feed water. Feed-water treatment, however, has reached such a stage of development that almost all conditions can be treated successfully.

If the water is reasonably clean and pure, a suitable boiler compound can usually be prescribed to counteract the effect of the trouble-making ingredients. The problem in other cases can be solved by some special treating apparatus such as the lime-soda or zeolite process. In many other cases, especially in large plants where water is unsuitable, it may be better to install an evaporating plant and distill all makeup feed. Even where so-called pure distilled water is used for makeup, it is necessary to make periodic tests of the water and to maintain a slight alkalinity by supplying a proper amount of suitable boiler compound. If the proper treatment is given, it is possible to prevent corrosion and the deposit of scale.

No doubt there are many plants where feed-water treatment is applied and where scaling and corrosion are not prevented. A feed-water chemist, after suitable investigation, could in most such cases prescribe the proper treatment, while the operating engineer might not be sufficiently informed of the chemical action to solve the problem. Even where fairly satisfactory results are secured, the conditions might be improved by impartial chemical investigation. Where bad conditions abound, an investigation by a competent industrial chemist might give the proper treatment. The expense of such an investigation is usually trivial compared to the cost of overhaul caused by improper feed water, and there is hardly any case that cannot be solved by a little intelligent investigation and experiment.

Recent research work has disclosed a vast fund of useful information on this subject, but the problem of definitely applying this information in a practical manner to the numerous plants that could make use of it is still present. The means for making feed water harmless under almost any condition are known to science. The methods of applying suitable treatment are not unduly expensive. The conditions are, however, variable and somewhat complicated, and the application of the proper remedy is not always apparent except to those who really understand the problem. The recent investigation of the A.S.M.E. committee on boiler-feed treatment has accumulated a reliable fund of information on this problem, but in many cases expert chemical knowledge of the reactions of the ingredients in the water is necessary to interpret and apply this information properly.

Priming, Foaming and Contaminated Steam

A special source of trouble in smaller power plants is contamination of the steam by moisture carried over from the boiler. This condition is aggravated by dirty feed water and particularly by the presence of oil in the condensate. The first step is to remove the trouble-making ingredients from the water by means of filters. This would take care of sand, mud and other solid materials that are not actually in solution. The next step is proper chemical treatment of water to prevent foaming, and the third step appears to be the use of proper separating or steam cleaning devices in the boiler dry pipe. This last step may be necessary only in case the first two cannot be successfully applied.

If the feed is pure or if effective water treatment can be applied and the boiler and steam piping are well designed to secure dry steam, then the need for the steam cleaning device is relatively less. However, we have here a more or less complicated problem which can be solved

by the combined talent of the engineer and the chemist. The trouble can be prevented if the proper steps are taken. The troubles often are the cause of great expense.

It may be mentioned that the conditions often cannot be generalized, nor can general remedies be applied in many cases. Conditions differ in different plants, and a thorough investigation may be required to ascertain the real causes of the trouble and to indicate the exact remedy in any particular case.

Dirty steam caused by dirty or improperly treated feed water is responsible for much unnecessary expense. It is fully as important to have clean and uncontaminated steam as it is to have clean heating surfaces.

Chemical Solutions for Protecting Piping

There are certain chemical solutions which, when added to the water, will act to protect the piping from deteriorating and prevent scale or deposit forming therein. One of the best known of these is silicate of soda which materially arrests the corrosive action of water pipes, both hot and cold. A light coating of milk of lime has been found beneficial in some systems. Chemical investigation of special conditions can no doubt prescribe other solutions which would guard against deterioration and which will remove the accumulation that may have formed. There are certain special protective paints or bitumastic mixtures that may be applied with a brush or spray and that act as efficient protectors to the interiors of piping systems. A further application of chemical knowledge in this field would undoubtedly reveal new ways and means for cheaply protecting various systems. However, no great progress will be made until these matters are actually tried out and applied experimentally.

At present, various special solutions and mixtures are being marketed by firms that have developed these materials. When applied for the particular purpose for which they are suitable, they are of great value; when applied or used under unsuitable conditions, they become an unnecessary expense. The ordinary power plant does not have experts that can tell definitely about the intricate details of these things, but a consulting industrial chemist can tell either directly or, by making certain tests and investigations, approximately what is likely to give service and where a certain proposed application is likely to be suitable. It will be seen that the proper and consistent use of the services of an industrial chemist will develop successful applications out of what may otherwise be a hazy maze of conflicting claims. Materials for any particular service have been developed and can be made available, but what is needed is some impartial expert to prescribe the material that will best answer requirements in any given case.

Other Applications of Chemistry

The use of chemical solvents and chemical film protection has other applications in industrial power plants; the following may be mentioned:

The deposit of scale in evaporators can be lessened by use of certain chemicals similar to those used for treating feed water. Silicate of soda is effective in this field. Various colloids may also be of use.

The cleaning of condenser tubes, feed heater tubes, oil coolers, etc., can be made much easier and less expensive by the use of proper solvents and chemical cleaning mixtures, based on the chemical nature of the deposit to be removed. Weak acids can sometimes be applied in an effective way.

The removal of oil deposits mixed with dirt or soot can be made comparatively easy by the use of chemical mixtures suitable for the particular problem in hand. Within the last few years special cleaners have been developed by certain manufacturers. These have a useful and wide application. But for any particular case there still is the problem of selecting the mixture that will best accomplish the job. The industrial chemist could often give definite and valuable advice. Certain old stand-bys such as lye, caustic soda, gasoline and kerosene are quite generally used, but the cleaning efficiency of these materials can often be greatly increased by the addition of special ingredients. For instance, the addition of about 5 per cent of starch to a soda-ash mixture will materially improve its ability to remove mineral oil deposits. Tri-sodium-phosphate can be used to great advantage provided it is properly applied. By knowing just what to use, the cost of industrial cleaning can be much lessened, and an effort to determine this information is well worth while. The manufacturers of cleaning mixtures will give much valuable information, but a large plant might find it profitable to have a special investigation made to determine the best materials and methods to use.

> When power plants make as full use of chemistry to secure economy and efficiency as is now made of thermodynamics, a long step forward will have been taken.

Protective Paints and Coatings

An examination of conditions by an expert with chemical knowledge and using the best practical data might disclose a plan for the use of paint, rust preventives or other protective coatings which would not only be cheaper to apply, but also would give much greater protection.

For certain places petroleum rust preventives will be cheaper and more effective than costly paints; for others an inexpensive paint may be better than an expensive one. Where the metal parts are subjected to salt air or corrosive chemical fumes, more or less special materials should be used. The general operator knows some of these things, but expert chemical advice after thorough examination of the special conditions would no doubt develop a much more efficient scheme for the application of protective coatings.

The paint bill is large; in spite of it metals deteriorate. An expert in the use of protective coating could reduce both the paint bill and the corrosion of metal structures in power plants.

The problem of preventing deterioration of metal structures involves something more than the application of various coatings. The application of these coatings should be predicated upon a thorough chemical investigation of the special conditions and the probable causes

of corrosive action. After this has been done, the most suitable protective coating for each place can then be selected. A great deal of this is now done haphazard.

Clean and Air-Free Water and Steam

Air and moisture make a combination responsible for much destruction. If air can be kept out of the water and out of the steam, great savings in overhaul may be secured.

Air can be removed from feed water by means of deaërating apparatus and, furthermore, condensers and pumping systems can be designed so as to reduce the amount of contained air. The destructive effect of air in feed water is pretty well known, but the air in the steam also has a bad effect on efficiency. This air is heated in the boiler, where it assists priming and occupies space in the piping and superheater, where it is likely to facilitate corrosion; then it enters the turbine, where it detracts from the efficiency of the steam and also increases deterioration of turbine blading. Again it enters the condenser, causing extra back pressure and rendering the cooling surface less effective.

The problem of excluding air is one in which all hands can co-operate. The operators on any existing plant can do a great deal to prevent the entrance of air. They can also suggest modifications in the plant that will assist. While the real remedy is a carefully laid down design, intelligently operated, there are also many partway measures that may help and that may cost little or nothing. The essential thing is to develop a thorough consciousness on the part of all concerned that air should be kept out at all times by any practical means. Much air is allowed to enter through carelessness and inattention, and many operatives are really unaware of the harmful effects that are caused by air in the feed water and in the steam.

There have been indicated herein some fields in which the application of scientific preventives to check corrosion and loss in operating efficiency might be exploited to a greater degree than they are at present. In this field scientific knowledge can greatly assist the practical operator. The way to do it appears to be to provide some easy and practical method for introducing reliable scientific knowledge and the results of laboratory tests into every-day practice. The most practical way appears to be by industry utilizing the services of consulting chemists and testing laboratories to such an extent that there will be enough business in this field to attract chemical engineers to this line of work and to have them provide the necessary laboratory equipment to make the tests and analyses required.

Means for Employing Chemical Advice

Large firms could employ their own chemists and provide them with certain equipment. But a better way would be to have both large and small plants in any locality secure temporarily or on retainer the services of an industrial chemical laboratory. Such a laboratory, if supported properly by the industry, could equip itself with personnel and apparatus that might serve hundreds of plants, and as they made their investigations and applied remedies, the knowledge and experience thus gained would accumulate so that in a few years they would be able to solve easily and at slight expense most of the problems presented, and would be in a position to widen their field of application.

The consulting chemist, with the adjunct of thoroughly equipped laboratory and the benefit of the experience of numerous practitioners, would have a great field of usefulness. Would it not be advisable for public service corporations and owners of large industrial plants in any general locality to co-operate and collaborate in establishing such laboratories for general consulting work in this field?

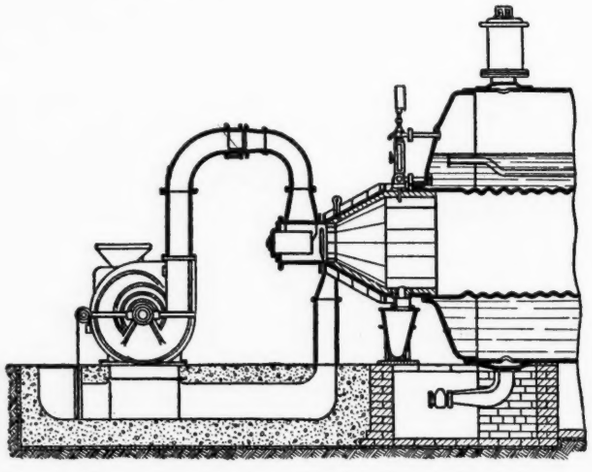
The power industry could surely make its expenses less by more definitely using scientific chemical information in the solution of problems that, after all, involve fundamental chemical reactions. Thus far government laboratories and those connected with educational institutions have done pioneer work in developing data and information, but the industry itself must provide the experts who can translate this highly technical information into actual widespread application.

Power plants now appear to be using thermodynamic knowledge almost to the limit to secure economy and efficiency. When they have similarly used and applied all the available chemical knowledge in the field of preventing avoidable deterioration, an important step in economy of effort and conservation will have been taken.

Using Pulverized Coal in Small Boilers

THE inherent advantages of the internally fired boiler has led to renewed efforts to improve its efficiency, which include the application of pulverized-coal firing, according to *Colliery Engineering*.

The illustration shows an internally fired boiler equipped with a short-flame Hobbeck burner, to which



Pulverized-coal firing applied to an internally fired boiler

the fuel is supplied by a unit pulverizing mill. The burner is attached to a conically shaped mixing chamber lined with firebrick and measuring 54 in. over-all. The primary air enters the burner with the coal. The secondary air is preheated by passing it through the annular space surrounding the refractory lining. It enters the chamber at the throat, where it creates an intense turbulence that secures intimate mixture of the fuel and air.

Although not shown by the drawing, the refractory lining of the mixing chamber extends into the boiler furnace for a distance of 119 in. along the top and 48 in. along the bottom, forming a combustion chamber.

A double-flue boiler equipped with two burners gave an efficiency of 80 per cent.

How to Prevent Wasting of Steam Turbine Blades

By Edward Ingham, A.M.I.Mech.E.

THE blades of steam turbines are liable to wasting from two causes, corrosion and erosion. Corrosion is the result of chemical action and consists of a gradual eating away of the metal. Erosion is caused by mechanical action, the particles of metal being gradually removed by impact and friction of the steam; the action is greatly accentuated should the steam carry a small amount of foreign matter from the boilers.

The blading of a steam turbine is the most important part of the machine, and for the best results it is essential that the blades should be carefully designed and shaped and that the true form should not be in any way affected by wasting.

Selecting the Proper Material

The first consideration, so far as the prevention of wasting is concerned, is the material.

In the past a large number of different metals and alloys have been employed for turbine blading, but many of these have proved unsatisfactory in actual service, and the general tendency nowadays is to employ certain alloys of copper and certain special steels.

Brass, an alloy of copper and zinc, is fairly resistant to corrosion, but not to erosion. Phosphor bronze, an alloy of copper and tin with a little phosphorus, is well able to resist both corrosion and erosion. Certain alloy steels are not only capable of resisting both forms of wasting, but they possess high tensile strength and are generally suitable to meet the most exacting conditions.

The choice of suitable material is not, of course, governed merely by the capabilities of the material to resist corrosion and erosion. Such factors as strength, ductility and cheapness of production have all to be considered.

Nickel steel, especially the variety containing about 5 per cent nickel, has been largely used and has proved satisfactory, but it is sometimes objected to on the ground that it is subject to rust. There is an increasing tendency to use the stainless or rustless steels, which are alloys of steel and chromium.

These steels have proved themselves excellent in resisting wasting, even when unpolished. With most materials polishing of the blades is highly essential, as it increases the resistance both to corrosion and erosion.

Polishing is also desirable from the point of view of strength. Experiment and research have shown that the tendency of a part to fail under stress is less the smoother the surface. Imperfections in the surfaces cause localization of stress and may thus lead to fractures.

How Operating Conditions Affect Blade Washers

The tendency to blade wasting depends largely upon the conditions under which the turbine is operated. If the wasting is to be reduced to the minimum, the turbine must be fed with steam that is both dry and clean. Many turbine users cannot believe it possible for foreign matter to be carried over with the steam from the boilers, but there is no doubt that, if the feed water is impure, a considerable amount of matter may be deposited in the turbine. This deposit leads not only to blade erosion, but to choking of the clearance spaces, increased stresses on the blades, and occasionally to vibration and breakdown. Hence, it is imperative that the steam should be clean, and to this end the water admitted to the boilers should be pure. If the feed water is impure, it should be treated externally, that is, in a special water softener, so that neither scale-forming matter nor the reagents employed for bringing about the chemical reactions shall enter the boiler.

Internal treatment, such as the introduction of soda or boiler compound, adds to the solid matter in the water, and by causing priming may greatly increase the tendency for impurities to be carried out by the steam. It is well to note that the strainers commonly used frequently fail to arrest the solid matter, especially when this is in the form of very fine particles.

Besides causing erosion, the impurities carried over with the steam may lead to severe corrosion, depending upon their nature and upon the material of which the blades are constructed. Caustic soda, which is probably used more than any other reagent for internal treatment, may be expected to cause corrosion of blades constructed of copper alloy.

Pure feed water is thus seen to be an important factor in the prevention of blade wasting, a point unfortunately not appreciated by many turbine users.

Nevertheless, the use of pure water is not a perfect guarantee of freedom from corrosion. There is good reason for believing that oxygen is frequently responsible for blade wasting, and deoxidization of the water may therefore be necessary to insure immunity from the trouble.

Within the last few years much thought has been given to the question of purifying the steam before it leaves the boilers, and several successful purifiers are now on the market that are capable of removing not only all solid impurities, but the great bulk of moisture in suspension.

Special precautions to prevent corrosion and erosion need to be taken when a turbine is to be shut down for long periods. If the blading is left wet, rusting and corrosion will proceed uninterrupted. Furthermore, when the machine is again started up, the rust particles will be driven forward by the rapidly moving steam and will lead to more or less severe erosion. Hence the machine should be kept dry.

Blade Corrosion May Lead to Boiler Corrosion

Before concluding, it may not be out of place to point out that corrosion of turbine blading may lead to corrosion of the boilers under certain circumstances. An interesting example of this was given some years ago in the *Journal of the American Society of Naval Engineers* by Commander J. E. Palmer.

The boiler was of the water-tube type and was used on board a vessel equipped with a Parsons turbine. After only about two months' service, a number of the water tubes failed as the result of pitting, and the boiler had to be retubed after four months.

An examination of the defective tubes showed a brownish deposit about the pitted parts, little nodules having formed over the "pits." An analysis of the deposit indicated the presence of copper. How the copper had gained entrance to the boiler was not at first evident, but on examination of the turbine it was found that the blades, which were of bronze containing a high percentage of copper, had suffered a certain amount of erosion. The eroded metal had evidently been carried away by the exhaust steam into the condenser, from where it had passed into the feed water and so into the boiler. The presence of the copper in the tubes thus set up galvanic action, which in turn caused pitting of the tubes.

POWER TRANSFORMERS

Types of Cores Used

By Charles A. Armstrong

Transformer applications and the reason why they are made are briefly discussed, after which the different types of core construction are detailed. There have been, in recent years, many changes in transformer construction. This is the first of three articles discussing these changes.

TRANSFORMERS provide a simple and reliable means of changing alternating current to any desired voltage. The popularity of the alternating-current system is due to this fact more than any other. Until recently, 13,200 volts was the highest for which alternating-current generators were designed. This value has been extended to 22,000 volts in one large machine under construction. But even this voltage is far too low to transmit large blocks of power long distances. Voltages up to 220,000 are in use on a number of systems.

Where voltages higher than that of the generator are required, transformers must be employed to step up the voltage. On the end of the line the voltage is stepped down through transformers to the desired value. One reason for transmitting power at high voltage is the reduction in the size of the conductor that can be made to transmit a given amount of power. For example, 2,000 kva. at 22,000 volts, three phase, is transmitted by 53 amperes and conductors of a size to carry this current may be used. At 220 volts the wire would have to be large enough to transmit 5,300 amperes. Allowing the same percentage voltage drop in both cases, the copper will have to be 10,000 times as large for 220 volts as for 22,000. This clearly shows the advantages of using high voltage to transmit large blocks of power long distances.

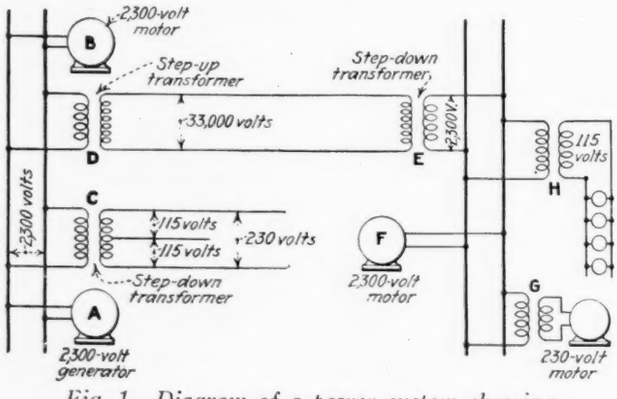


Fig. 1—Diagram of a power system showing various ways transformers are used

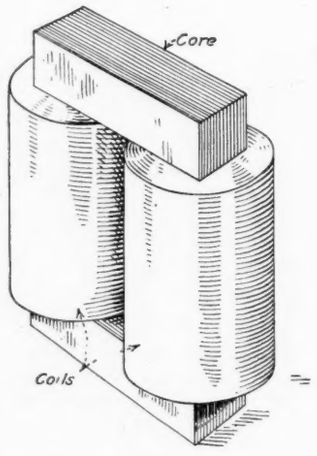


Fig. 2—Core-type transformer

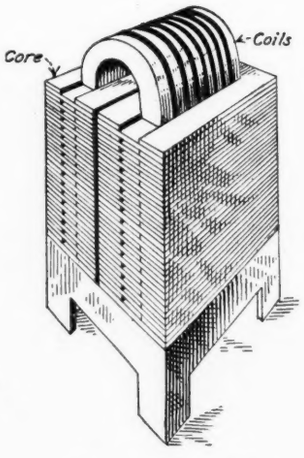


Fig. 3—Shell-type transformer

Fig. 1, in a general way, shows what may be found in an alternating-current system. The 2,300-volt generator *A* is connected to a busbar from which power is supplied at 2,300 volts to motor *B*. Power is also supplied, through the step-down transformer *C*, at 115 volts for lights and 230 volts for small motors. Distant services are taken care of by increasing the voltage through a step-up transformer *D*. At the load end of the line the voltage is reduced for power distribution through a step-down transformer *E*. Large motor *F* may be operated directly on the 2,300 volts. Transformers may be used to step the voltages down to 460 or to 230 for motor operation, as at *G*. Other transformers may be used to step the 2,300-volt power down to 115 volts for lights, as at *H*.

Combinations of transformers and other equipment vary widely with different systems, but Fig. 1 gives a general idea.

Instead of alternating current being used directly as such, it is frequently converted into direct current by rotary converters, motor-generator sets, mercury-vapor or other types of rectifiers. Transformers are used with these equipments with the exception of motor-generator sets that operate at generator voltages.

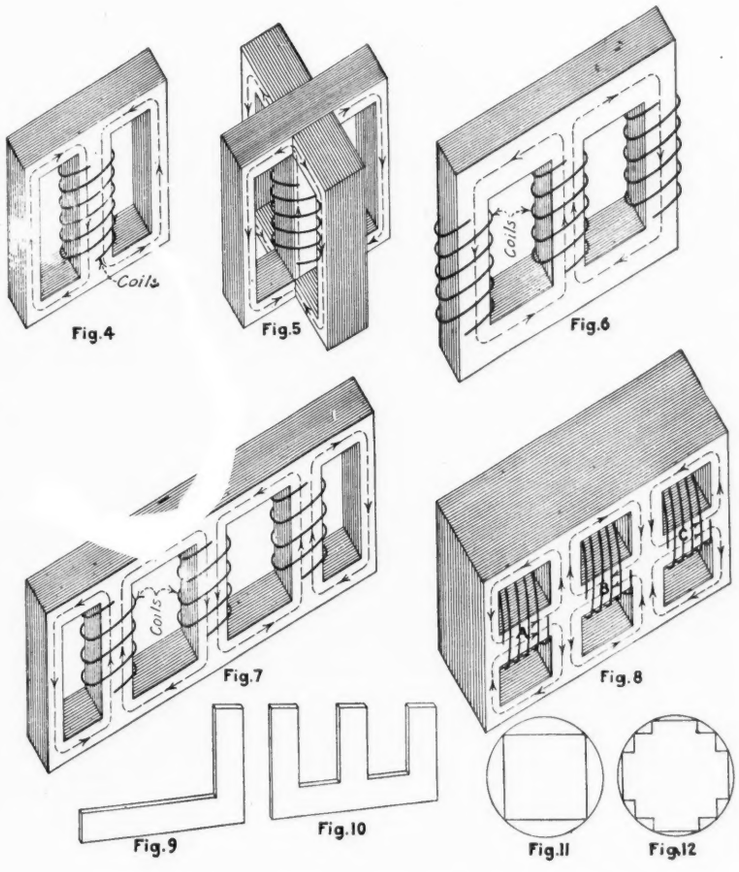
To take the power through so many devices, such as stepping the voltage up and then down once or twice before it is delivered to the utilization equipment, may appear to be uneconomical. Transformers have no moving parts, therefore can be designed to have a high efficiency. With the large sizes efficiencies of over 99 per cent have been obtained. Even in the small sizes the efficiency is high; for example, a one-kva. 60-cycle 2,300- to 230-volt transformer will have a full-load efficiency of over 95 per cent. The half-load efficiency will be about one per cent less. A similar transformer designed for 25 cycles will have an efficiency about one per cent less than 60-cycle equipment. For transformers of 5,000-kva. capacity and larger, the difference in efficiency between a 60- and a 25-cycle unit is only about 0.4 per cent. Since transformers have no moving parts, they can be readily constructed for operation outdoors and require only a small amount of attention, so that their installation and maintenance costs are low. These factors and the large saving in line copper, already referred to, make the wide use of transformers economical.

Transformers may be classed as power, testing, metering, sign, bell-ringing, etc. In this article power transformers only will be discussed. Every transformer consists of two windings, wound on an iron core. The winding connected to the power supply is known as primary and the one connected to the load as the secondary. In the usual arrangement there is no electrical connection between the two windings.

If the primary winding is connected to a source of alternating current, there will be induced in the secondary winding a voltage by magnetic induction. This action is similar to that between the primary and secondary of an induction coil. The value of the voltage induced in the secondary is almost in a direct ratio to the number of turns in the two windings. For example, if the primary has 1,000 turns and is connected to 2,300 volts and the secondary has 100 turns, there will be 230 volts induced in the secondary. On the other hand, if the secondary has 5,000 turns, it will have induced in it, $2{,}300 \times 5 = 11{,}500$ volts.

Power transformers are built in two general types, core and shell. In the core type the coils are put on over the core as in Fig. 2, and in the shell type the core is built around the coils as in Fig. 3. Both types have their advantages and disadvantages, and both are in wide use with modifications. The most serious objection to the shell type, shown in Fig. 3, is that the coils cannot be inspected without dismantling the core. However, with modern transformers of high reliability and the better quality of insulating oil used, the inability to inspect the coils without taking the transformer apart is not so objectionable as it used to be.

In addition to the two core and coil arrangements shown in Figs. 2 and 3, there are a number of modifications of these. In the form Fig. 4 the coils are on the center leg and there are two magnetic circuits, as indicated by the dotted lines. This is a development



Figs. 4 to 12—Types of cores used in transformers

Fig. 4—Three-leg core for single-phase transformer. Fig. 5—Distributed type of core. Figs. 6 and 7—Core forms for core-type three-phase transformers. Fig. 8—Core for shell-type three-phase transformer. Figs. 9 and 10—Lamination shapes used in cores. Figs. 11 and 12—Cross-sectional shapes of cores.

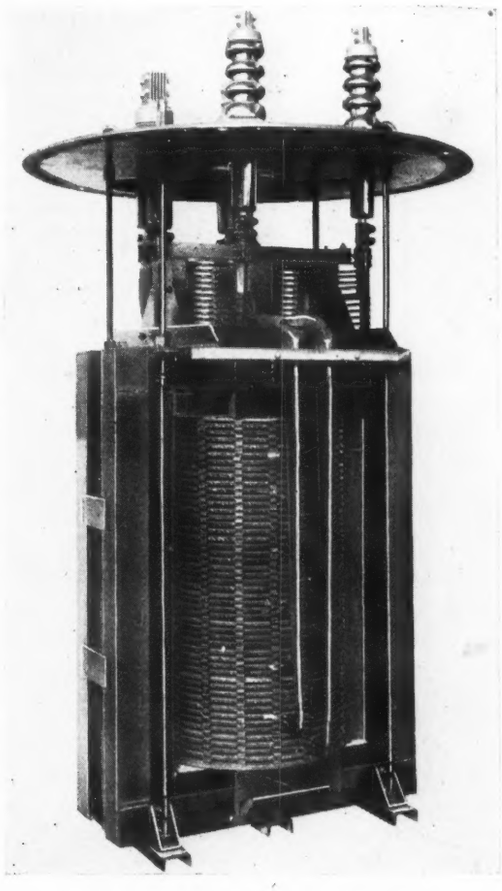


Fig. 13—Complete assembly of a single-phase transformer with a three-leg core

toward distributing the core around the outside of the coils and is a modified form of a shell type that exposes the outside of the coils so that they can be inspected. A further distribution of the core about the outside of the coils is shown in Fig. 5. Cores have been used that have only three external legs, spaced 120 deg. apart around the coils. In Europe distributed core transformers have been designed and built with 24 external legs. Such a core practically incloses the coils in an iron shell.

Figs. 6 to 8 show core and coil arrangements for

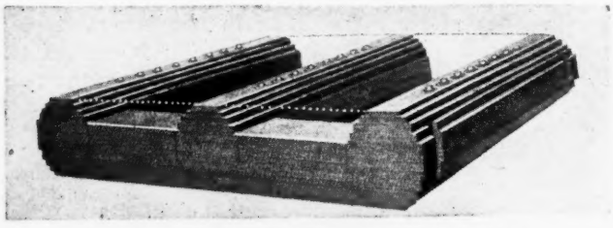


Fig. 14—Bottom yoke partly assembled in the legs of a three-phase core

three-phase transformers. The form Fig. 6 has three legs with a primary and a secondary winding on each leg. This is a core-type construction. In Fig. 7 two more legs have been added to the core, but only for the magnectic circuit. This core is comparable with that in Fig. 4, except that one is for three-phase and the other single-phase construction. The three-phase shell type is shown in Fig. 8. This is the same kind of construction as in Fig. 3 applied to a three-phase transformer. The horizontal position of the cores shown in Figs. 6 to 8, is not the one always used in practice. In some arrangements the core is placed on end so that one coil is above the other in the containing tank.

Iron Losses and Copper Losses

The losses in transformers are due to eddy currents and hysteresis in the core and are known as iron losses; and to the resistance of the winding to the flow of the current, called the copper losses. The copper losses vary with the load, being practically negligible at no load and at a maximum at full load. The iron losses are practically constant. Since many transformers are left connected to the line whether they are loaded or not, it is necessary that the iron losses be kept low. To do this the core is built up of thin sheets of silicon steel. The sheets are about 14 mils thick for 60-cycle and 25 mils thick for 25-cycle transformers. This steel is low in carbon and contains about 3.5 to 5 per cent silicon.

The chief function of laminating the core is to keep down the eddy currents. After the sheets from which the core is to be assembled are punched, they are subjected to an annealing process to remove any hard spots that may exist in them. This process also forms a coat of oxide on the surfaces of the sheets that increases the resistance in the path of the eddy currents. To insulate one sheet from another more effectively, a coat of insulating varnish is put on one and sometimes both their sides. In large sizes some manufacturers put a sheet of asbestos or paper at intervals in the core when it is assembled. This is generally done if the core is subjected to high mechanical pressures.

Low hysteresis losses are obtained by annealing the sheets. The steel used in the earlier transformers had the undesirable feature of increasing hysteresis losses after the transformer was put in service. This characteristic is called aging. In some old transformers the hysteresis losses more than doubled owing to this aging process. The cores of modern transformers, made of high silicon steel, are practically non-aging. In some cases the hysteresis losses may decrease slightly instead of increase. Well designed transformers with high-silicon steel cores will have iron losses equal to about one-half the copper losses at full load. This ratio will vary somewhat with the size, voltage and frequency of the transformer, but for an average value the one to two ratio of iron to copper losses may be taken as fairly representative.

Punching the Sheets

The sheets from which the cores are built are punched in various forms depending on the size and shape of the core. For shell-type transformers the cores are frequently built of sheets that are rectangular in shape, laid to form a complete layer in the core, as in Fig. 16. The succeeding layer is placed so as to break joints with the preceding one. In this way the joints in the core are made to have high magnetic qualities. Sheets punched in the shape of an L, Fig. 9, or an E, Fig. 10, are also frequently used.

Fig. 14 shows the partly assembled core for a large three-phase transformer. The legs of the core are first assembled and bolted together under heavy pressure, with insulated bolts. The yoke is then assembled on the legs and held in place by a heavy structural steel frame as

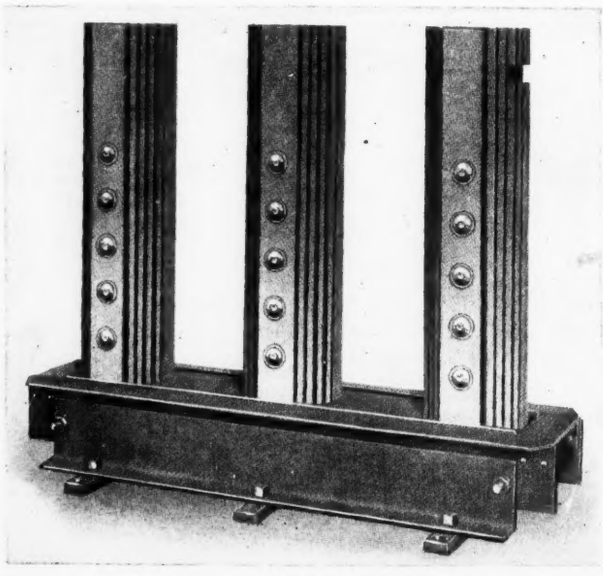


Fig. 15—Structural-steel frame in place on bottom type of the core

in Fig. 15, in which form the core is ready for the insulation and assembly of the coils.

If the laminations in the core are all made the same width, the core is square or rectangular in cross-section. Square or rectangular coils are used to a considerable extent in transformer construction, even on those of the core type.

Circular coils are used, quite generally, as they tend to resist better the mechanical forces they are subjected to during short circuits or heavy overloads. They are also easier to construct, and where molded insulation is used between the high- and the low-voltage windings,

or between the windings and the core, this material is easier to produce in the form of cylinders than a casing of rectangular cross-section.

A circular coil on a square core, as in Fig. 11, leaves considerable space between the core and coil that might as well be filled with iron. In fact, only 63 per cent of

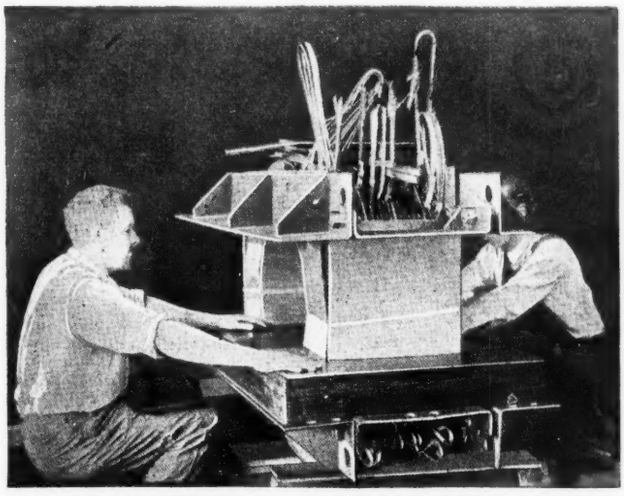


Fig. 16—Assembling the core on the coils of a single-phase shell-type transformer

the space inside the coil is filled with iron. If the cross-section of the core is stepped—that is, made a cruciform shape as in Fig. 12—it will more nearly approach the cross-section of a circle. A core of the form shown in the figure will fill 87 per cent of the space in the coil with iron. To obtain a better-shaped core for use in circular coils, many cores are made cruciform, examples of which are shown in Figs. 14 and 15. After the core is insulated and the coil assembled in place, the core and supporting frame are completed, as shown in Fig. 13. The unit shown in the figure is complete with the cover ready to be placed in the tank.

There are two methods of making the joint in the top yoke of the core —the interleaved joint and the butt. In the former method every other lamination in the leg and yoke is made the width of the leg shorter than the other. This allows the longer pieces in the yoke to take the place of the shorter ones in the legs. A joint of this kind is simple and has good magnetic properties, but requires considerable time to separate the end of the laminations and interleave them.

In one type of butt joint the ends of the legs and the inside of the yoke are finished to make a good magnetic connection, are butted together and held under heavy pressure. The top yoke may also be built in, as shown in Fig. 14, between the core legs and held under heavy pressure by the supporting frame.

It is necessary that the laminations be held under heavy pressure or the transformer will be noisy when in operation. No matter how tightly the core may be clamped, the transformer, when alive, will always emit a hum, and this is one of the ways to tell if it is connected to a source of power.

Steel Switchboard Panels Reduce Installation Costs

By A. J. A. Peterson

Switchboard Engineering Department, Westinghouse Electric & Manufacturing Company

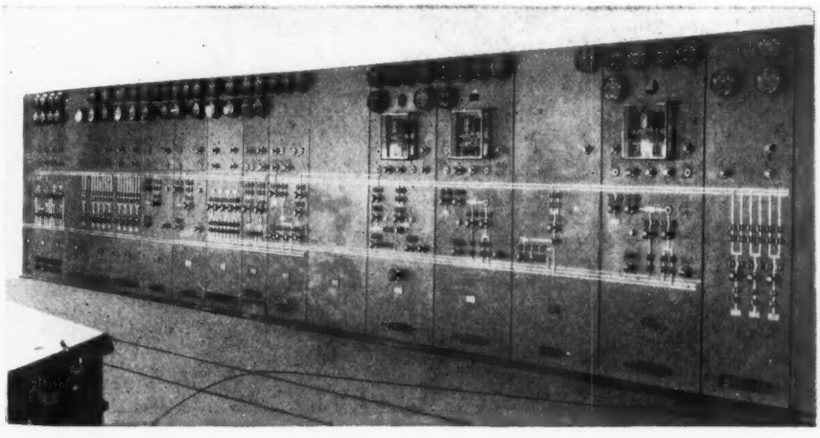
THE advent of the modern steel panel has revolutionized the usual method and procedure of erecting switchboards. Many power stations report reductions in installation costs of from 50 per cent to 75 per cent and are taking advantage of these savings by purchasing steel panels for switchboard use, wherever possible.

It is conceded that steel panels have an improved appearance, permanence of finish and absence from fracture. But of major importance is the reduction in installed cost that can be made by the use of these panels. This results primarily from the reduction in weight, a slate panel with angle-iron framework weighing approximately 600 lb., while the equivalent steel panel weighs only 100 lb. The lower weight reduces freight and cartage charges. The increased strength and the reduced weight permit the complete assembly of all instruments, relays and other such apparatus on the panel. This equipment was formerly shipped separately, and the elimination of such separate shipment thereby further reduces the transportation cost.

With this assembly the construction force is required to handle one crate containing a completely equipped panel instead of one main crate and several smaller crates. This reduces the handling cost, as well as the expense formerly required for mounting these instruments on the panel and subsequently connecting them up to the wiring on the board.

Single-piece construction of the panel permits alignment in a switchboard without the difficulties met with in the multi-section panel of slate or marble, which usually involves many parts to permit of proper assembly.

Improved methods of wiring, which utilize the channel sides of the panel, together with connections to instruments and terminal blocks, eliminate all connection work on the panel and facilitate further inspection and even subsequent alteration.



Complete switchboard assembled from steel panels

With the switchboard equipment completely installed on the panel, the manufacturer makes complete performance tests, proving the correctness of the wiring, connections of polyphase and directional instruments, etc. In addition, the complete panel can be effectively grounded.

High Spots of the

LONDON FUEL CONFERENCE

FIFTEEN hundred delegates representing forty-eight countries presented one hundred and seventy papers before the London Fuel Conference, Sept. 24 to Oct. 6.

The Marquis of Reading, who served as President of the Conference, pointed out in opening the meeting that the nations represented were met without regard to political views or even with the desire to add to their particular nations' assets, but with the desire to contribute to a rapidly advancing civilization fundamentally dependent upon power. Sir David Milne Watson, president of the National Gas Council, in reply pointed out that no greater impetus could be given to the cause of world peace than by the meeting of scientists and engineers from all nations to discuss their common interests.

This report was prepared by H. W. Brooks, one of the American delegates and a special representative of *Power,* who gratefully acknowledges the co-operation of the Secretariat of the Conference in permitting the use of the general reports of the sessions. Fuller abstracts of some of the papers will appear in later issues.

Owing to the preponderance of the use of coal as a fuel, about two-thirds of the papers concerned the preparation and use of coal. To give an idea of how vital coal is to the economic life of Great Britain, Sir Robert Horne stated that one-twelfth the population of Great Britain are dependent upon the coal industry for their livelihood, and four-fifths of the volume of British exports and one-tenth of their value normally consisted of coal. Indeed, Sir Robert stated that "the modern prosperity of Great Britain was created by coal, and by coal only it be saved, but this only would be by the adoption of improved and more economical methods of using it." To give an idea of the losses and extravagances involved in the waste of coal, he estimated that no less than three million tons of potential fuel in England alone went into the air each year in the form of soot.

To give an idea of the wide variety of subjects dealt with during the meetings, the subjects of the sessions are as follows:

SUBJECTS OF SESSIONS

Section A. Coal Industry—Economical and general considerations.
Section B. Sampling and testing of solid fuels.
Section C. Coal treatment—cleaning, drying and briquetting.
Section D. Storage and handling of solid fuels by the user.
Section E. Oil industry—Economical and general considerations.
Section F. Composition, classification, preparation, storage and handling of liquid fuels.
Section G. Carbonization Industry—Economical and general considerations.
Section H. Composition, classification, preparation, storage and handling of gaseous fuels and of the products of the carbonization industry.
Section J. Utilization of fuels, including electricity for domestic purposes.
Section M. Pulverized fuel.
Section N. Internal-combustion engines.
Section O. Transmission of power.
Section P. Waste-heat recovery.
Section Q. Low-temperature carbonization.
Section R. Peat.
Section T. Training of fuel technicians.
Section V. Organizations concerned with the efficient use of fuel in industry.
Section W. Economic possibilities in the better reorganization of fuel utilization

Among these the papers of greatest interest to *Power* readers concern the pulverization of fuel, low-temperature carbonization, internal-combustion engines, and the utilization of fuels for steam generation.

From this standpoint one of the most important papers was that by A. C. Fieldner, of the U. S. Bureau of Mines, on "The Classification of Coal." Mr. Fieldner described the investigations by the American Engineering Standards Committee in conjunction with the American Society of Testing Materials, who have appointed three technical committees to review the whole question. The first is concerned with the scientific classification based on chemical and physical properties, and with reference to origin and constitution. The second is detailed to develop a system of classification, based primarily on the uses of coal in commercial practice; the third, the Marketing Practice Committee, was formed to collect and correlate the information on present commercial practice for the benefit of the Classification Committees. The work is now well under way, the committees having the active support of both producers and consumers of coal, who realize that grade classification will provide a better understanding between buyer and seller, and will result in working each class of coal into the use for which it has the most value.

Europe Uses Lower-Grade Coals

In the session for the utilization of low-grade fuels, the American delegates could not fail to be impressed with the relatively high-grade fuels now being utilized in America as compared to some of the fuels with which other nations are compelled to deal. In Australia, for example, Yallourn coals with 64 per cent of moisture and Morwell coals of 50 per cent moisture are being successfully burned on mechanical step grates with the use of preheated air.

In Korea the Japanese have designed a new type of carbonization for the low-temperature treatment of low-grade Korean brown coals. The oils and gases are being recovered and the carbonized residue used for pulverized fuel firing. The Japanese propose to install mine mouth power plants on the sites of some of the Korean mines.

It was shown further that by far the majority of European coals must be beneficiated by cleaning, drying or briquetting. In the United States less than five per cent of bituminous coal mined is thus prepared although such processes are now rapidly being adopted.

The papers on the storage and handling of coals dealt principally with European practice. Both the Belgian and the German State Railways, for example, have de-

vised and installed elaborate coal mixing plants to insure the use of a uniform quality of coal. In many cases coals from various districts are blended and sized under chemical control to produce the most efficient results. In Belgium this necessitated the blending of coal from 200 sources and their distribution to 100 substations.

The gravity bucket elevator is much used in gas works and power stations, but its use to bring out ashes as well as elevate coal is declining. Skip hoists are also widely employed for the smaller stations, especially for lumpy material. Pneumatic conveying was also discussed. Despite its simplicity the system is costly and difficulties are experienced with many materials. Conveying of coal by mixing it with water and pumping as done at the Hammersmith Power Station, was recommended for consideration.

Low-Temperature Carbonization

In the session on low-temperature carbonization, it was pointed out that in central Germany low-temperature carbonization of brown coal has been practiced for nearly eighty years; but of the many forms of apparatus introduced for the treatment of bituminous coal during the War owing to the oil shortage, only those have survived which were capable of producing a salable domestic low-temperature coke.

In Great Britain there are at present more than sixteen plants in operation capable of dealing with ten tons or more daily, and all excepting one using cannel coal, are treating ordinary bituminous coals with the main object of producing a solid smokeless fuel for domestic purposes. Successful trials have been made of the use of low-temperature coke in gas producers for motor traction and for a distance of thirty miles the consumption of a lorry of 6-ton over-all weight was 2.6 lb. per mile. Further developments in this direction would make Europe much less dependent on American supplies of gasoline.

Prof. J. W. Cobb (Great Britain) showed that the thermal efficiency of the carbonization process, allowing for the heat used and lost in the manufacture, has increased from 70 per cent in 1919 to 85 per cent at the present time. For the modern plant with waste-heat boilers, a modern carbureted-water plant works with an over-all efficiency of about 70 per cent.

At the Dunston plant of the Newcastle Electricity Supply Company, described by R. B. Sloan, the low-temperature plant produces only low-temperature tar oils as a byproduct, the low-temperature coke and gas produced being burned under the boilers. Under British price conditions this operation shows a profit to the central station of about 75c. per ton of coal processed, when fixed charges are disregarded. The fixed charges on this plant, however, are greater than the profit mentioned, so that commercial economies have not yet been attained. It is expected, however, that redesign of the plant on a larger scale may effect anticipated economies.

Unlike Europe, coke-oven coke is being successfully sold in competition with anthracite in many parts of America, as was pointed out in the paper contributed by the United States Bureau of Mines. In England the domestic user is slow in accepting this view owing to the large percentage of house-heating being done in open-fire grates requiring a slow-burning fuel of high radiating power. It was pointed out that there is a steady increase in the number of merchant coke plants sold in America, not connected with blast furnaces. Such plants in 1927 sold nearly 40 per cent of their coke output for domestic use. This coke contains volatile from 0.7 to 2 per cent with 7 to 15 per cent ash, and is sold in carefully screened sizes. In England, however, the carbonization of coal at high temperature does not seem to be the answer as a domestic fuel as long as the grate fire is continued.

> While from the technical aspect low-temperature carbonization plants can be worked to produce coke, tar and gas in adequate quantity and quality, the results of long period commercial operation in selling large quantities of the products in the open market and producing actual profits to stockholders, are still awaited. There are undoubtedly local conditions under which properly selected plants may be expected to be a commercial success. *View of the Department of Scientific and Industrial Research of Great Britain.*

Pulverized Coal

In the session on pulverized fuel, the papers concerned principally research, preparation and utilization, powdered fuel for power station work, metallurgical work and marine practice, and the combustion of unusual fuels in powdered form. There still remains to be solved a number of problems concerning the design of combustion chambers, fineness of grinding, fusion point of coal ash, the grinding process itself and the disposal of flue dust in pulverized-fuel-fired plants. Development of water-cooled walls and water screens was discussed and attention was called to the development of the turbulent combustion furnace. Considerable differences of opinion were evident among the various authors and the delegates as to the fields of application of the unit system and the bin-and-feeder system. In Russia, for example, only the unit system is being employed, preheated air being successfully used in air-swept mills to handle the very wet Russian lignites. Rosencrants (Great Britain), on the other hand, compared the advantages of the two systems to the distinct favor of the storage system. This was also the view of Kreisinger and Frisch.

The evil effect of ash on eroding furnaces has been largely eliminated by the water wall, but there still remains the erosion of fans, air heaters, economizers and ducts. The logical step seems to be the elimination of the ash in the first place from the fuel as supplied by the colliery, and it is interesting to inquire as to the possibilities of coal-cleaning plants being applied at power stations if clean supplies of coal cannot be secured direct from the mines.

In Japan a new pulverizer of the impact type known as the "Hirotani" has been developed and several experimental installations made, apparently with considerable success. In Russia a wide range of fuel, varying from lignites to anthracites, has

been successfully burned in pulverized form. By Jan. 1, 1932, the proposed capacity of the pulverized-fuel-fired stations in Soviet Russia will amount to 394,000 kw., the largest plant being the Shterov Station, using anthracite culm and having an output of 180,000 kw. Professor Ramzin, of Russia, gave the results obtained with pulverized coal as against stoker-fired units, showing why pulverized fuel has been standardized by the Russian government in its new plant-construction program. The Russian anthracite culm contains about 18 per cent ash and for efficient combustion must be ground to a fineness of about 90 per cent through a 200-mesh. The air is supplied at about 500 deg. F. and water screens are used.

In Czechoslovakia the adoption of pulverized coal presents possibilities, since the Mydlovary lignite is the most inferior coal in that country. Previous to the adoption of pulverized-coal firing, it was impossible to obtain high steaming rates on grates with this coal. Now at the Mydlovary power station in South Bohemia, which is a mine-mouth plant, this coal is first subjected to a wet-preparation treatment, then dried in steam-tube driers and cooled before grinding.

Pulverized fuel in marine service was discussed in a paper by H. W. Brooks (United States), who described the preliminary tests at the Philadelphia Navy Yard as well as the results obtained during the six trans-Atlantic voyages of the Shipping Board steamer "Mercer." In spite of difficulties, efficiencies of over 75 per cent have been obtained and it is generally felt that the application of pulverized fuel to marine service will increase rapidly. It is rather too early to say with confidence that marine pulverized fuel has proved an unqualified success from an economic point of view, but its technical feasibility is at this time unquestioned. The British have recently equipped the steamship "Stuartstar" which has lately returned from a trip to South America. Only about one-eighth of the boiler capacity of this vessel was powdered-coal fired, although she is now being re-equipped, so that on her next voyage about 50 per cent of her capacity will be so fired. It is understood that a second vessel, the name of which has not yet been made public, has been equipped in Great Britain on the Brand & Lang system. This vessel is understood to be in the Mediterranean at the time of this writing, but no record of the results has yet been made public.

> The dust nuisance from the stacks of power stations is probably felt more keenly in Great Britain than in America, as the usual British coal is of higher ash content and with the greater humidity of the atmosphere the dust falls to the ground within a comparatively short distance of the power station.

Appropriations for Further Research

Still a third ship is under construction, using the Fraser & Chalmers system. It is understood that all three of the British ventures involve high-speed impact pulverizers, while the four American ships (s.s. "Mercer," s.s. "Lingan," New York Harbor Tug "Flannery" and "Mississippi Warrior," river steamboat) have so far used the ball mill. It is understood that the British government has appropriated £100,000 for further research on marine pulverized-fuel firing to be carried out by the Department of Scientific and Industrial Research.

The papers on liquid fuels dealt with recent advances in cracking; the characteristics of motor fuels; refining; the composition and chemical properties of Russian oils and Polish natural gases; storage handling and transmission of liquid fuels; production, supply, availability and methods of recovery of Alberta (Canada) bituminous oil sands and Colorado oil shales for the production of fuel and lubricating oils. The United States Bureau of Mines contribution described the experimental shale oil plant established under its auspices in Colorado and discussed the oil shale resources of the United States, the characteristics of American oil shale developments, technical and economical problems of the industry and a future program of work.

Heavy Oil-Engine Fuels

The subject of heavy fuels for internal-combustion engines is important because at present the supply of heavy and cheaper petroleum fuels is much greater than that of gasoline, and because in the future such supplies can be more readily supplemented by the distillation of coal and shale and by the use of even vegetable oils. The suitability of various available oils for present-day internal-combustion engines and the relation of this to laboratory analyses was discussed by H. Moore. Special requirements of the heavy-oil engine impose extra limitations on the character of the fuel. In general, the higher the compression the less exacting its requirement as to the chemical nature of the fuel. The heavy-oil engine user expects that:

1. The fuel shall be free from foreign matter, particularly inorganic material.
2. It should have a high calorific value.
3. It should be consumed with a clear exhaust and freedom from coking or fouling of the combustion chamber, so that the engine can be run for long periods without overhaul.
4. The ignition temperature should be sufficiently low to permit starting from cold.
5. The oil should not congeal at ordinary low temperatures.

Taking up these points in detail:

The influence of the ash is shown to depend to some extent on its chemical nature. A limit of 0.05 per cent is usually specified, but if the ash is of a non-abrasive nature, as sodium compounds, this figure may be exceeded.

There is comparatively little variation in the heat value of petroleum oils. The coal-tar oils, which vary greatly according to the mother coal, differ from petroleum oils in containing oxygenated bodies such as cresols and have consequently low calorific values. The same applies to the vegetable oils.

The completeness of the combustion in the cylinder can be considered only in relation to engine design. Assuming easy ignition, then clean combustion depends primarily on the timing and adjustment of the fuel valve to the viscosity of the oil and to a less extent depends on the chemical nature of the oil, particularly on the content of hard asphalt, that is, the component which is insoluble in petroleum ether. To the presence of this

hard asphalt is usually attributed carbon formation in the cylinders and smoky exhaust.

However, where such oil is used it was the author's experience that large low-speed two-stroke-cycle engines give the better results. Hard asphalt is absent from distilled oils, and it is partly on this account that these oils are preferred. Certain residual oils that are practically free from hard asphalt are excellent heavy-oil engine fuels.

In addition to the foregoing the sulphur content should be mentioned. There appears to be no direct relation between sulphur content of an oil and its behavior in an engine, except so far as the sulphur may be a component of the hard asphalt. Apart from silencer corrosion, the presence of sulphur seems to have no deleterious effect.

An important factor is the ease of ignition of spontaneous ignition temperature. This is the factor which differentiates between coal-tar oils and petroleum fuels. The former have such high ignition temperatures that it is often found necessary to arrange for pilot ignition gear when using them. The shale oils, lignite oils and vegetable oils have not this disadvantage.

Advantages of High-Speed Engines

The papers by Professors Defays and Hubendick discussed the relative advantages of the heavy-oil engine and the gasoline engine and suggested lines of future development. Professor Defays divided heavy-fuel engines into three classes—low-speed, moderate-speed and high-speed engines—and discussed the advantages of high-speed engines. Several moderate-speed engines are now on the market. The Held-Rallye engine is cited as a case of successful development of the high-speed type.

If, as appears likely for some time to come, the cost of the heavy fuels of the gas-oil type remains well below that of the present price of motor fuel, the heavy-oil engine will offer a distinct advantage in the matter of fuel costs. The principal economic consequences of the use of heavy-oil engines for transport and the general use of high-speed heavy-fuel oil engines would be an increase in the proportion of the world supply of suitable liquid fuels, together with a simplification of the refining processes necessary with a concurrent reduction in cost, and the further development in the cost of transport generally.

Data on Supercharging

A paper entitled "Diesel Engines Fitted with Exhaust Turbine Driven Superchargers," by Büchi (Germany) deals thoroughly with the application to large slow-running Diesel engines of exhaust-driven superchargers of the type developed for aircraft during the war. The first part of the paper deals with theoretical considerations and reiterates the arguments put forward by the exponents of exhaust-driven superchargers for aircraft. The author makes a great point of the scavenging of the exhaust products after completion of the exhaust stroke and advocates a valve timing giving an appreciable overlap between the opening of the air-inlet valves and the closing of the exhaust valves. It is pointed out that the scavenging effect obtained thereby serves both to increase the weight of air in the cylinder and at the same time to cool internally the cylinder walls, piston head, and more particularly the exhaust valves, thus to a large extent compensating for the increased heat flow due both to the greater volume of heat and to the higher initial air temperature.

The author next described a series of tests carried out on a large six-cylinder four-cycle Diesel engine, to which this system of supercharging was applied. The test results obtained bear out the arguments that as the power output is increased by supercharging, the heat flow to the cylinder walls, pistons, valves, etc., is increased at a somewhat lower rate. Since the mechanical losses are virtually unaffected by the addition of the turbine supercharger, it follows that the mechanical efficiency increases steadily with increase of load. The maximum load recorded during the tests corresponded to a brake mean pressure of about 133 lb. per sq.in., which was obtained with a supercharge of 7.11 lb. per sq.in. (gage) with the turbine running at slightly over 6,000 r.p.m.

Coal Cheaper to Transport Than Electricity

In the session on transmission of power, Dr. E. W. Smith (Great Britain) presented from authoritative sources data on the cost per therm (100,000 B.t.u.) of potential heat of transmitting coal, coke, oil, gas and electricity over distances of from 5 to 100 miles. The cost of conveying one therm of potential heat in the form of coal or coke by rail in Great Britain is less than that of conveying it in the form of oil. The cost of transmitting electricity is on the whole much more expensive than for coal, oil or gas. It depends largely on the load factor and the system of distribution. Taking as an example, a distance of 50 miles, the cost varies from 1½c. to ½c. per therm, according as the load factor decreases from 100 to 25 per cent. In Germany long-distance gas transmission has enabled coke-oven gas plants to find a commercial outlet for large quantities of gas to compete with electricity in many cases, and has permitted local gas works, which were running at a loss, to be closed, the area being supplied by long-distance transmission.

Waste Heat Recovery

In the session dealing with waste-heat recovery considerable data were given showing the amounts of steam which can and are being obtained from waste-heat boilers applied to a number of well-known industrial heating processes. It is stated, for instance, that in a steel works it is practicable to raise 3,000 lb. of steam, or about 100 hp. per ton of finished steel, from the waste heat from open-hearth furnaces, soaking pits and reheating furnaces.

There has been of recent years in Great Britain a rapid development of the practice of steam raising from the waste gases of the carbonizing plants on gas works. In fact, it is recognized that where there is a demand for steam, steam raising is the cheapest form of waste-heat recovery on continuous vertical carbonizing plants, and the practice of preheating air has largely been abandoned.

A distinction is made when considering which type of boiler, water-tube or fire-tube, is most suitable for waste-heat recovery. The distinction depends on the temperature of the gases. If above about 1,000 deg. C., a considerable proportion of the heat can be transmitted to the boiler by radiation and the water-tube boiler is suitable. With gases of lower temperature, the fire-tube boiler seems to hold an unchallengeable field.

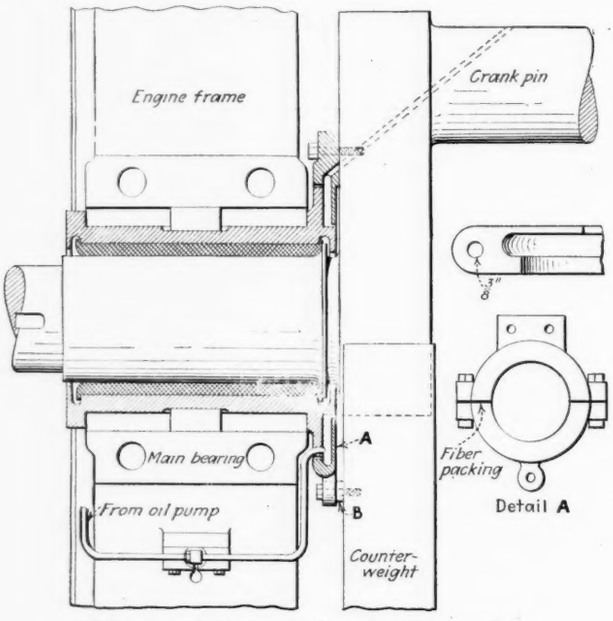
In connection with the recovery of heat in the form of steam from the exhaust gases of marine oil engines it is suggested that the steam should be used for operating a steam-driven generating set, the exhaust steam being used for accommodation heating, cooking, etc.

Right Out of the Plant

BOILED-DOWN EXPERIENCE PASSED ALONG TO THOSE WHO MUST SAVE MONEY, IMPROVE THE PRODUCT AND KEEP THE PLANT RUNNING

Improved Centrifugal Engine Oiler for Internal-Combustion Engines

IF NOT provided with crankcase splash or force-feed lubrication, modern internal-combustion engines are fitted with centrifugal oilers to lubricate the crankpin bearings. I never heard any complaint about these oilers, although some of them are just fastened to the crank webs by $\frac{5}{16}$ or $\frac{3}{8}$ bolts, the lower or bottom part of the



Oiler attached to crank and counterweight

ring not being secured at all. I refer to one-cylinder engines up to 130 horsepower.

In the sketch an improved type of oiler is shown. The bearing shell is flanged and the oil ring shaped so as to encircle the flange with about $\frac{1}{32}$ in. clearance. In this way a closed trough is formed, in which lubricating oil is fed through a $\frac{1}{8}$-in. pipe, the end of it being located in a hole filed in the flanges of the top and bottom bearing shells, some clearance, of course, being allowed.

The top part of the oiler is connected to the crank web by two $\frac{1}{2}$-in. capscrews and the bottom part by one $\frac{3}{8}$-in. capacity. The bottom screw is slipped through a $\frac{1}{2}$-in. bushing *B*. This bushing is screwed down until it touches the counterweight, and the ring is finally fastened by means of the $\frac{3}{8}$-in. capscrew, thereby making a good connection without straining the oiler. As counterweights are usually rough castings, this method is simple and practical.

The top and bottom parts of the ring are connected by two $\frac{3}{8}$-in. bolts with a $\frac{3}{16}$-in. fiber packing on the joint so as to provide some flexibility when the oiler and flange are not exactly in line.

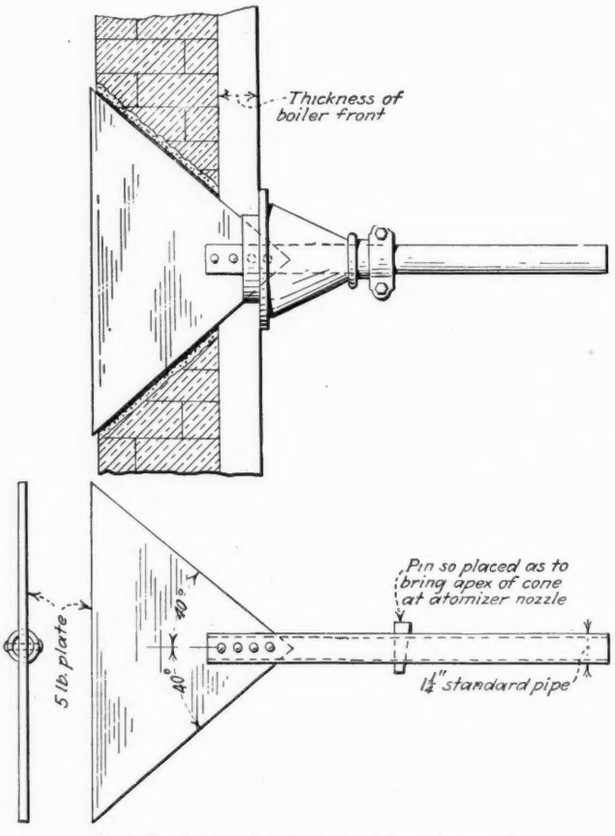
H. WIELAND LOS.

Epe, Holland.

Spray Templet for Checking Boiler Cones

THE cones in use in the boilers of the United States naval destroyers are generally molded in place, and considerable trouble has been caused by the plastic cracking and breaking off. This condition was somewhat improved by using firebrick so far as was practical at the sides of and below the plastic refractory around burners, the purpose being to reduce the size of the plastic as much as possible and minimize the danger of cracking and breaking away.

This method was still improved by using only firebrick, shaping the cones by breaking the ends of the brick and grinding to shape. A light layer of plastic was then applied. Trouble was encountered on account



Detail of templet for checking the angle of furnace cones

of there being no method of checking the angle of the cones made this way, and on numerous occasions it was found that the angle was off the center of the opening.

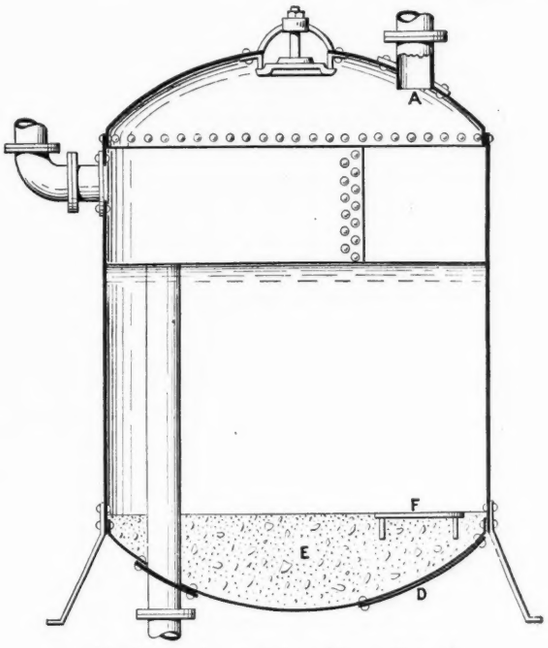
The spray templet, as shown in the illustration, was made at a small cost for material and labor and has given good results.

EARLE S. NASON,

Boston, Mass. Chief Machinist, U. S. Navy Yard.

How a Leak Was Stopped in Blowoff Tank

THE blowoff tank was in the boiler room basement. After ten or twelve years it began to leak, and examination showed that a large patch on the bottom directly beneath the inlet *A* was necessary. Apparently, the erosion was caused by the cutting action of the stream of water, for it was not observed elsewhere. The



Method of repairing blowoff tank

depth of water in the tank was about 4 ft., thickness of bottom plate $\frac{5}{8}$ in. and the boiler steam pressure 195 lb.

The patch *D* was put on the bottom plate and about 12 in. of concrete placed in the bottom of the tank. In addition an old blank flange *F* with several short nipples screwed into it, was laid in the concrete opposite the inlet *A*, the top of the flange being even with the top of the concrete. These repairs were made many years ago and the tank has not leaked since. W. L. PARKER.

Elgin, Ill.

Overheating of Rotary Converter Coils

IN A rotary converter the coils adjacent to the slip rings tend to heat more than the other coils. The current distribution in the armature is uneven, the momentary current at any point being the momentary value of the alternating current superimposed on the value of the direct current, the greatest root mean square value of the combined currents being carried by the coils connected to the slip-ring tappings. This causes these coils to be always slightly overloaded and therefore more heated than the other coils. This current is increased if the converter is operated at a low power factor.

Where rotary converters are being operated at a low power factor, the rating of the converter should be slightly reduced, otherwise there is danger of these coils being overheated sufficiently to burn out, while the remainder of the armature coils may not be heated dangerously high, which would probably cause the overheated coils to be unnoticed. W. W. EMERSON.

Brentford, England.

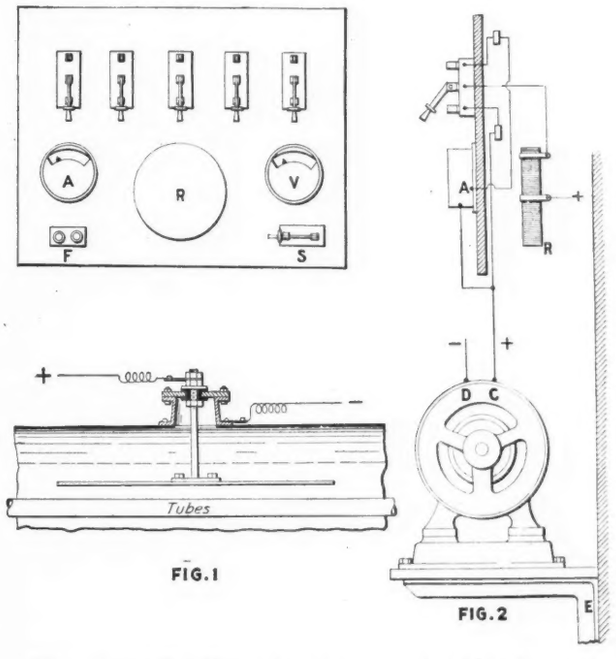
Protecting Heating Boilers from Pitting and Corrosion

WE ARE operating two low-pressure horizontal return-tubular boilers, of 2,000 sq.ft. heating surface. We have prevented pitting and corrosion entirely by a system of electrolytic protection which attracts all the metal-destroying properties in the water to a soft steel plate $\frac{1}{2}$ in. thick, 12 in. wide, 8 ft. long. The plate is suspended 3 in. above the top row of tubes and is insulated from the main shell of the boiler as is shown in Fig. 1.

This plate is connected to the positive side of a 10-volt 10-ampere motor-driven dynamo, the boiler being connected to the negative side of the line. In addition to the two boilers we operate two hot-water generators and one rubbish burner, each of which is fitted with a plate and connected to the system. Each plate has 2 amperes at 10 volts going through it 24 hours a day during the entire heating season. A plate will last about two seasons.

Although there are systems of this kind available, our system was made up and installed by ourselves. I had learned something about electrolysis and electrochemical actions while studying electrochemistry. We purchased the motor generator set and assembled the system, the general arrangement being shown in Fig. 2.

Each of the double-throw switches connects to one of the units. The resistance shown at the back of the board



Figs. 1 and 2—How plate is suspended in boiler and diagram of connections

is a 10-ohm tube. By throwing the switch into the upper contact, the current flows through the ammeter and by moving the band up or down gives the rate of flow desired.

The system will not prevent scale, but is practically 100 per cent effective against corrosion, particularly where the boiler feed is largely made up of condensate or where a purifying system is used and the water becomes solvent and corrosive. S. H. NAGLE,

Philadelphia, Pa. Plant Engineer, Packard, Inc.

As the Other Fellow Sees It

WHERE THE MAN WHO AGREES OR DISAGREES WITH AUTHORS OR EDITORS HAS A CHANCE TO SPEAK UP

Taking Samples of Transformer Oil

When samples of transformer oil are taken for testing, between the time it is taken from the transformer tank until it is tested, chemical changes may take place in the oil if it is carelessly stored. Either glass or tin containers may be used. The former are sometimes considered preferable, as they permit the oil to be examined visually for water and solid impurities before testing. These glass bottles must be chemically clean before use. The glass should be of a good grade such as is used for chemical and medical work. Low-grade articles improperly annealed contain impurities in the pores of the glass which may work out and contaminate the oil. When containing oil these bottles must be kept in the dark until the oil is tested for color and sludge forming, as the light causes a change in these properties.

Rubber stoppers should never be used in bottles. Stoppers made of a good quality cork only, kept from contact with the oil by a wrapping of tin foil, should be used. Where tin cans are used these should be joined on the outside. This is essential if the joints are soldered, as no solder should be allowed to come in contact with the oil.

W. E. WARNER.

Brentford, England.

* * * *

Another Method of Computing Area of Irregular Shapes

REFERRING to the method of computing area of irregular shapes given by L. G. Jones in the July 31 issue, where a precision balance is available, as it generally is at most industrial plants, the following is a quick and accurate method.

Lay out to scale on paper, cardboard or thin sheet

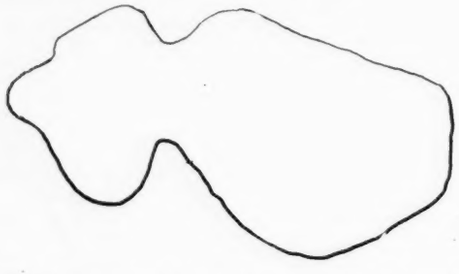


Fig. 1—Stope area is readily computed by weighing relative areas on paper

metal as desired, the relative areas, cut them out and weigh the parts.

I have for years used this method for the computing of underground stope areas as shown in Fig. 1. It is only necessary to cut out the scaled floor area, or a reduction of it, and then compare it with the weight of a scaled unit of the measurement used.

Referring to the illustration of the gate valve as given by Mr. Jones (reproduced herewith), a disk representing the full area through the valve, or area *A*, would be cut out and weighed, then the area *B* representing the opening through the valve could be cut from it and weighed. For example, if the piece representing the full area through the 12-in. valve (113 sq.in.) weighed 28 grams

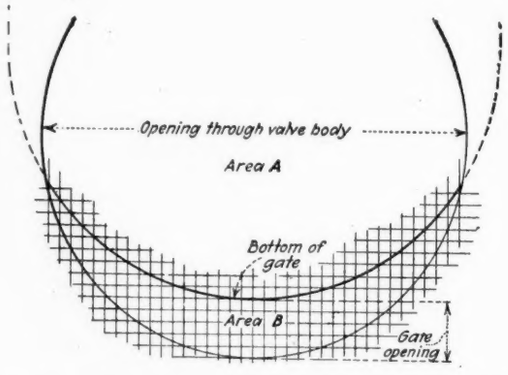


Fig. 2—Area of partial gate opening is found by weighing paper patterns of part A and part B

and the area *B* weighed 7 grams, the area *B* in square inches would be 28.25, which is equal to the area of a 6-in. pipe.

JOHN MOCINE.

Sonora, Calif.

* * * *

Chain-Grate Stoker Operates Without *Ignition Arch*

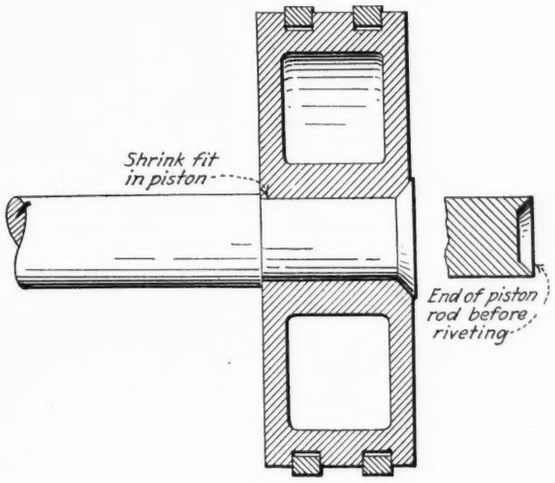
IN THE July 10, 1928, issue there appeared an article, entitled "Chain-Grate Stoker Operates Without Ignition Arch." This is based on the results obtained from a test of a German traveling-grate stoker that was installed without an ignition arch. These tests were made by the Dampfkessel Ueberwachungs-Verein der Zechen in the District of Dortmund, and the results were published by our engineer, Mr. Presser, in Vol. 24, 1928, of the mining paper called *Glueckauf*.

Your correspondent, Mr. Weisselberg, or his representative has disregarded the losses attributed by us to flying ash. This was evidently done with the assumption that the flying ash can be recovered and burned. It must be borne in mind, however, that the loss by flying ash can never be entirely recovered if this consists of very fine particles. A difference in opinion concerning this is, of course, possible. However, the principal reason for calling your attention to this is the fact that in the tabulation of test No. 2 the flying ash loss is given as being 6.33 per cent instead of the actual 0.33 per cent, which results in a heat balance of 106 per cent. This unintentional error may reflect on the accuracy of our testing, among engineers. We therefore request that you kindly jublish a correction of this error and would appreciate your mentioning at the same time that your article was based on the tests conducted by our society.

Essen, Germany. F. V. HUNDERTMARK.

Improved Piston for Small Steam Engines

I READ the article by D. A. Hampson on "Improved Pistons for Small Engines" in the Oct. 2 issue with considerable interest, as I was connected some years ago with a machine shop in the same line of work. We used a piston at that time which I think is better and simpler than the one shown by Mr. Hampson. It was a one-piece piston with cored chambers and was a shrink fit on the piston rod. The end of rod was machined as shown in the illustration and riveted over after being shrunk in the piston. This design has been in use on



Cored one-piece piston

numerous engines for twenty years, and I have never heard of one becoming loose.

The design shown by Mr. Hampson has the objection of increasing the clearance volume of the engine, which means increased steam consumption. There is also the possibility of the nut working loose and wrecking the engine.

PERCY JACKSON.

Cincinnati, Ohio.

* * * *

Does the Home-Made Policy Pay in the Power Plant?

IN THE Oct. 9 issue A. A. Tenney, of the Fitchburg Steam Engine Company, makes some pertinent observations regarding the policy of using home-made parts in the power plant. I have no doubt Mr. Tenney could have gone farther and have shown greater evil as the result of this policy, but I am inclined to think modesty restrained him.

There is no denying the fact that there are engineers engaged in operating machinery, who are fitted by experience and ability to make important alterations and repairs to machines intrusted to their care, but while one of this type may be met occasionally, the great majority are totally unfitted by lack of the proper experience. The contract repair shop is by no means excluded from this category; what applies to the engineers applies to it as well, when it comes to high-grade engine work.

The lathe, the planer, the shaper, the miller and other machine tools may be justified in the power plant, but some of the work they do is by no means justified. Machine tools are all right in competent hands, but there is no accounting the mischief they will do when some wise chief or master mechanic gets a brilliant idea in his head. I have known of over $180,000 worth of good working pumps ruined from this cause.

One of the most serious engine wrecks I know of could be ascribed directly to a master mechanic who though he was an engine builder.

Some years ago a public service corporation contracted for what was considered a rather large power unit at that time. The engine, which was a vertical cross-compound unit, had the valves in the top and bottom cylinder covers, and the designer, to reduce clearance to a minimum, had vee-shaped projections on the faces of the pistons that entered the valve ports. These projections were a source of nervous anxiety to the master mechanic, so he had the pistons removed and replaced by ones of his own design which were cored out and internally ribbed. He was rather dubious about the strength of these new pistons and, to satisfy himself, had a circle of large rivets put in the pistons between the periphery and the hub. The engine operated all right until the fall, when the heavy load came on; then one of the pistons broke around the ring of holes and fell to the bottom of the cylinder. There being nothing to guide accurately the nut on the end of the piston rod into its cavity in the cylinder cover, it struck the side of the hole and tore the valves and cover off the engine and completely wrecked that side.

Another case occurred to a similar engine elsewhere. A crankpin on a heavily loaded unit had been getting loose in the disk quite often, and as it was no small job to shrink a new one, the persons in charge decided to increase the tolerance. The sanity of this move would have been questioned by an engine builder, but unfortunately none was consulted. The engine ran along until the peak load season came, when the crank disk split into five pieces and wrecked the engine.

There is nothing more exasperating than to have some piece of home-made machine work fail just at the crucial moment, and generally when you are in a sizzling hot place. Some one breaks the stem of a boiler stop valve. Instead of getting a proper piece of forged bronze out of which to make the new stem, they will hunt around the machine-shop floor and in all probability will pick up a piece of ordinary yellow brass to make the stem out of, only to have it break in a short time.

One has to exercise a great deal of discrimination in the use of machine tools around a power plant. In repairs to important machinery the builders should be consulted.

FRANK P. MACNEILL.

New York City.

Combustion Boiled Down

There is constant demand for an exposition of the fundamental principles of combustion, boiled down for rapid study and reference. To meet this need *Power* will publish a series of three articles on the subject by Potter and Solberg. The first will appear in the November 6 issue.

What's New in Plant Equipment

HOW THE MANUFACTURER CONTRIBUTES TO THE JOB OF GENERATING TRANSMITTING AND APPLYING THE POWER SERVICES

A Welded Ice Machine

A RADICAL departure from the traditional design of small-capacity ice machines is shown in the new ammonia refrigerating machine recently put on the market by the Mansfield Ice Machine Company, Mansfield, Ohio. This new unit demonstrates what can be accomplished with welded steel in standard shapes and at a cost that is considerably below that of cast-iron construction.

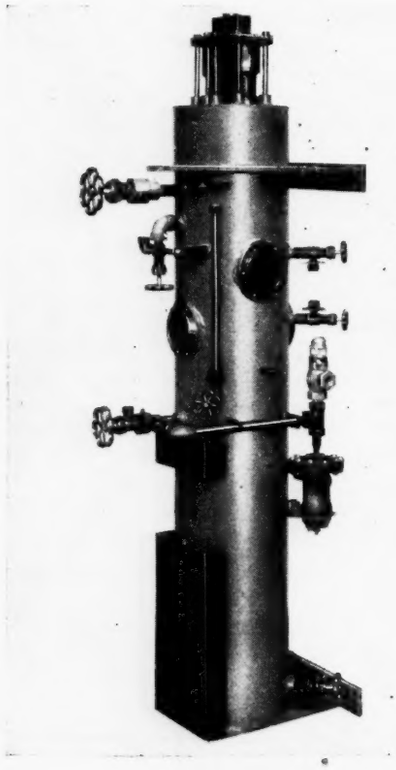


Fig. 1—The welded housing

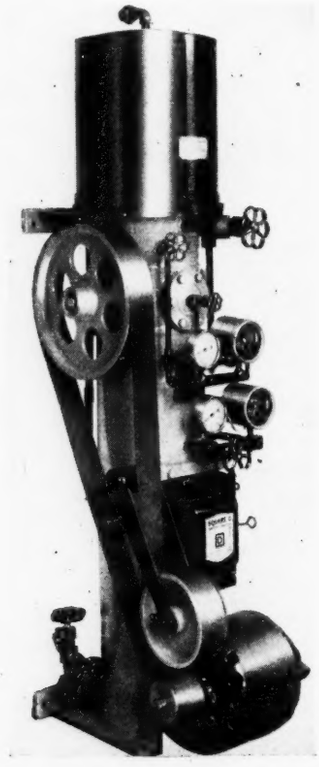


Fig. 2—assembled machine

In designing this machine the engineer disregarded all precedent and, starting with a clean slate, has produced a machine that is thoroughly modern in every respect.

The advanced design was made possible through the use of arc-welded steel construction. The mechanical advantages resulting from the new construction are reductions in size and weight. The weight of the new machine is less than half that of the usual cast-iron machine, and it occupies only 40 per cent of the floor space required by other ammonia machines.

With the exception of the compressor pistons and the flywheel, the entire machine is made of steel. The connecting rods and crankshaft are steel forgings, the rest of the parts being made from stock steel shapes such as round bars, plate, pipe, drawn seamless tubing and structural shapes.

By welding steel plates in the ends and the inside of a piece of 10-in. steel pipe, 56 in. long, the compressor housing and ammonia receiver for a refrigerating unit of 1,100 lb. ice-melting capacity is formed as shown in Fig. 1. Sections of drawn seamless tubing are arc-welded together to form the removable cylinders of the compressor, and the cylinder head is composed of two pieces of steel plate arc-welded together. The removable head is held down by bolts screwed into threaded sections of round bar stock welded to the top of the crankcase. These items can be noted in Fig. 2, a view of a partly completed machine.

Even the wristpin ends of the piston rods are sections of steel tubing welded to the forged rods. Another part which is built up by welding various pieces of steel together is the watertight housing of the condenser coils mounted on the top of the machine as shown in the view of the complete unit, Fig. 2. All the welding in the manufacture and assembly of the ice machine was done with "Stable-Arc" welders.

Credit for the ingenious design and construction of the new-type automatic ice machine should be given to M. H. Ackerman, president of the Mansfield Ice Machine Company.

New Control Switch for Electrically Operated Circuit Breakers

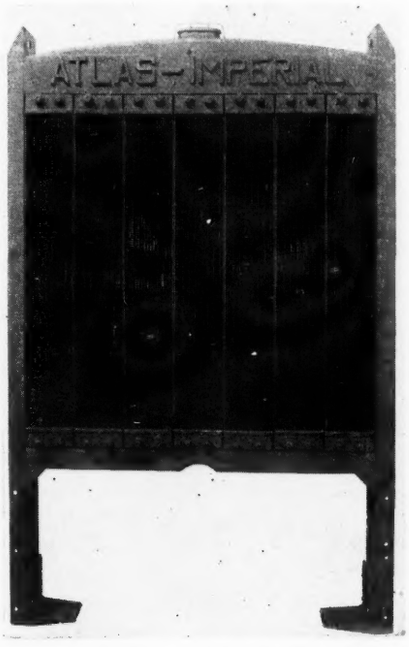
A NEW control switch for the remote operation of circuit breakers has been announced by the General Electric Company, Schenectady, N. Y. The switch is known as the "Turn-Pull" because a combined turning and in or out motion is required to operate it.

The handle is oval in shape and carries a metal strip insert which makes it possible to tell at a glance which operation was last carried out by the attendant. There are two positions of the handle, right for close and left for trip.

The main closing and tripping contacts are of the pivoted shoe type and are operated by the initial outward or inward motion of the switch shaft. The turning motion then operates four auxiliary silver-tipped contacts through the action of cams. Two of the latter contacts are placed in series with the main contacts, so that it is impossible to actuate the circuit breaker until the indicating switch handle is swung into the right or left position. The second pair of contacts are used singly, one for an indicating lamp and the other in the alarm bell circuit.

Radiator-Fan Unit for Diesel and Gas Engine

A NEW type of radiator for Diesel and heavy-duty gas engines has been announced by the Perfex Corporation, Milwaukee, Wis. Sizes from 50 to 350 hp. are now available. The new feature is the mounting of



Sectional radiator-fan unit

an unusually large air-circulating fan directly on the radiator frame. This is completely protected by a screen and shrouded to insure uniform air circulation over the entire radiator.

The fan is carried on anti-friction bearings and is provided with a large enough belt pulley to insure positive fan operation over long periods without attention. The radiators incorporate the latest developments in removable core sections, a feature that permits removal and repair of any individual section without dismantling and also allows continued operation of the power plant for reasonable periods while a section is out.

"Ladle Bronze" Quaker Babbitt Metal

A NEW type of Quaker bearing metal designated as "Ladle Bronze" and adaptable to practically all types of bearings and especially those subjected to extremely heavy pressures, is announced by the Monarch Metal Company, 119 So. Lincoln St., Chicago, Ill.

This metal, it is claimed, can be heated and poured in the usual way as readily as any babbitt metal and gives a good bearing surface without machining. It is further claimed that it pours freely and adheres readily to bronze, steel or iron linings, and in addition to its high strength and ability to withstand high pressure per unit of area, its weight per cubic inch is less than many other classes of babbitt.

Authoritative tests made on this metal have shown its physical properties to be as follows: Brinell hardness, 64.6; tensile strength, 21,500 lb. per sq.in.; compression of 1-in. cube at 14,000 lb., 0.002 in.; melting point, 860 deg. F., and weight per cubic inch, 0.233 pound.

Some of the uses to which this babbitt, by virtue of its composition, is especially adapted, are steam-turbine bearings, thrust bearings, internal-combustion-engine bearings and similar high-pressure services.

New Portable Flight Conveyor Made in Three Sizes

A PORTABLE flight conveyor, made in 21-, 26- and 31-ft. lengths and designed to handle all grades of coal and coke, from the smallest to the largest sizes, is a recent addition to the line of coal-handling equipment put out by the Link-Belt Company, Chicago, Ill.

The framework is made of angles and plates. All frame and trough members are bolted and can be easily renewed when necessary. Axles are of the swivel type, readily adjustable for different positions.

The conveying element, consisting of a double-strand chain with special attachments, move at a speed of 124 ft. per min. through a trough 24 in. wide. This gives the conveyor a capacity of 60 cu.ft. per min., or approximately 1½ tons a minute when handling coal.

The head shaft is provided with bronze-bushed take-up bearings, held in angle guides and adjusted by means of screws. The foot sprockets are bronze-bushed and revolve on a fixed shaft locked in place. The head shaft bearings and foot sprockets are lubricated through their shafts by pressure fittings.

The motor is completely inclosed by a sheet-metal housing, and all gears are protected by guards. The head shaft is driven from a countershaft with suitable reduction gearing by a 5-hp. motor. Countershaft bearings are of the self-lubricating type (graphite-bronze). The raising and lowering of the conveying element is accomplished by a chain arrangement of worm gearing and drive.

The machine may be operated in conjunction with an overhead I-beam trolley, chain block and bail. It may also be fitted with a screening chute and screens of the woven wire or bar type, depending upon the material to be handled.

Conveyor is made in 21-, 26- and 31-ft. lengths

Graphite Seal for Pipe Threads and Gaskets

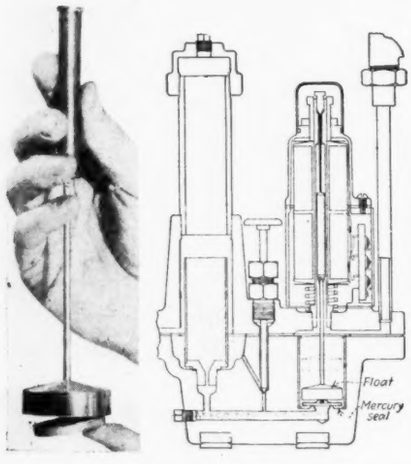
THE Joseph Dixon Crucible Company, Jersey City, N. J., has announced a new addition to its line of graphite products, to be known as graphite seal.

The new product is a graphite paste suitable for sealing screw threads, flange and gasket joints of pipe lines carrying hot or cold oils,

gasoline, etc. The paste, it is claimed, is insoluble in oils and gasoline and expands when subjected to heat, thus giving leakproof joints. It is further claimed that, owing to the graphite properties of this paste, the joints may be opened with ease at any time. It is also recommended for use on handhole and manhole plates, or wherever there is a flange and gasket connection.

Device for Preventing Mercury Losses in Flow-Meter Manometers

TO PREVENT the possibility of the mercury being blown out of the manometer used in its electric flow meter, owing to a sudden increase in flow, beyond the maximum capacity, the Brown Instrument



Blowout check disk and cross section of manometer showing location of check

Company, Philadelphia, Pa., has developed the special mercury blowout check illustrated.

The check is a simple and automatic arrangement consisting of a resilient disk, flexibly attached to the bottom of the float and a seat machined in the manometer body. If the downward travel of the float exceeds the value for maximum flow, the disk is dropped to a seat which closes the passage from the high-pressure leg to the low-pressure leg. The disk, being flexibly mounted, is free to seat itself instantly and tightly when the slightest excess flow occurs, thus preventing the upstream pressure from blowing mercury out of the downstream side. Further increase in flow simply makes the seal tighter. Normal action is resumed automatically.

Small Single and Double Speed Reducers

BOTH single and double speed reducers in sizes from $\frac{1}{4}$ to 5 hp. have been introduced by the Cullman Wheel Company, 1344 Altgeld St.,

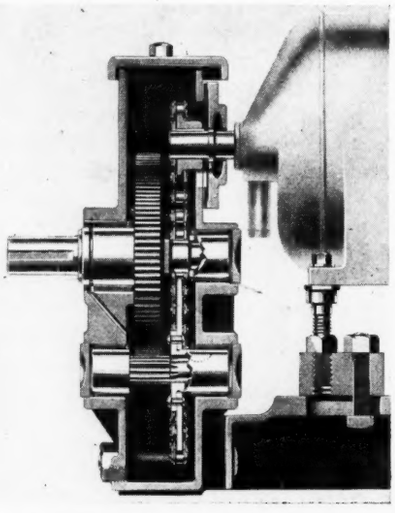


Fig. 1—Single-type speed reducer

Chicago, Ill. Both models have the housing, cover and motor case made of cast iron. The motor base is bolted to the reducer housing and is provided with adjustable studs so that the motor can be readily aligned with the reducer. No coupling is used between the reducer and the motor, the motor shaft extending into the reducer housing and carrying the chain sprocket.

The first reduction in both types is accomplished by a standard roller

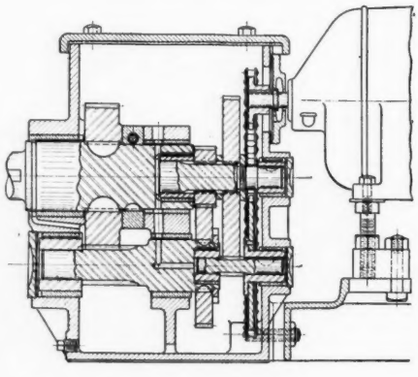


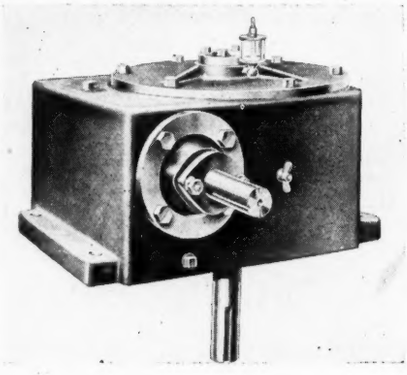
Fig. 2—Sectional view of double-type speed reducer

chain and sprockets. The speed can be reduced from two to six times in this step. The larger sprocket is mounted on a shaft having the second pinion cut thereon. As shown in Fig. 1, this pinion drives the main spur gear on the power output shaft. All bearings are phosphor bronze. The chain emerging from the oil furnishes a spray of lubricant to the gearing and bearings. It also acts as a flexible coupling.

Referring to Fig. 2, it will be seen that the large sprocket shaft and the first large driven gear shaft run in bearings formed by cylindrical bores in the two large shafts at the left. Passages are drilled in the large shafts for conveying lubricant to these bearings.

Improved Vertical-Type Heavy-Duty Worm-Gear Speed Reducer

THE D. O. James Manufacturing Company, 1120 West Monroe St., Chicago, has brought out an improved vertical type heavy-duty worm-gear speed reducer that is made to allow for vertical driving



Vertical speed reducer

with the driveshaft projecting at either top or bottom.

The cast-iron housing is provided with a large oil-cooling and heat radiating chamber. Roller bearings support both sides of the gearshaft, and the wormshaft is mounted on a double roller bearing on one side, and a single roller bearing on the other.

The gearshaft is 0.40 per cent carbon steel, made oversize to withstand emergency strains and starting loads. The worm is made integral with the shaft of chrome nickel steel, heat-treated, ground and fully relieved. The gear is of high-grade phosphor bronze with the larger sizes made up of a bronze ring, shrunk on and keyed to a cast-iron spider.

Twenty- to thirty-degree pressure angle teeth are standard, depending on the number of teeth in the worm and gear, and all gears are made with liberal face width.

Direct Firing of Boilers

*With Producer Gas**

By William B. Chapman
President, Chapman Stein Furnace Co.

Mr. Chapman predicts the development of an underfeed, mechanically operated, gas producer designed to go directly beneath a boiler and burn low-grade fuels, such as coke breeze and slack coal, with high efficiency. A start has been made in England with hand-operated producers placed beneath boilers. During the last year the author has been able to handle washer refuse under ⅛-in. satisfactorily in a rapidly agitated experimental producer. The fuel contained 56 per cent ash and 7½ per cent sulphur. Yet it burned with a CO_2 of 17 per cent. Progress has been made in cutting down the steam blast to the producer.

BOILERS will some day be fired with producer gas, for producer gas possesses practically all the advantages of pulverized coal and atomized oil without having their disadvantages.

At present the only gases available for boiler firing are natural gas and blast-furnace gas. One has an exceptionally high thermal value and the other an exceptionally low thermal value. Neither possesses much luminosity. Producer gas, on the other hand, has an intermediate thermal value and, because of its tar vapor and carbon content, is highly luminous.

Producer Gas Easily Controlled

Producer gas can be controlled in quantity as easily as pulverized coal or oil—it merely requires the movement of a valve, which can be made automatic. The amount of air required for making producer gas plus the air needed for burning it is the same as the amount of air required for burning pulverized coal, except that producer gas requires only half as much excess air. The CO_2 in the burnt "stack" gases from producer gas made from coke breeze averages about 18 per cent and from producer gas made from bituminous coal about 17 per cent. This compares favorably with pulverized coal, where the CO_2 seldom exceeds 14 per cent.

The difficulties of using pulverized coal for boiler firing are largely due to the fact that the ashes are left in suspension after the fuel is consumed. With producer gas the ashes are left on the grate, and water-cooled walls would not be required under a boiler any more than they are now required in a forge furnace, a glass tank or an open-hearth furnace.

Experience with Small Boilers

The small boilers now using producer gas can be brought up to the full load in fifteen minutes on Monday morning after the week-end shutdown. The boiler efficiency when using coke breeze, which is the chief fuel now used, is 80 per cent. This would be a high efficiency for such low-grade fuel even in large central power stations.

Large boilers have never been heated efficiently with producer gas. This is due to the fact that no gas producer adapted to meet the peculiar demands for boiler firing has ever been built. The author does not even know of any attempt that has ever been made to devise a gas producer specially adapted to meet the requirements of firing large boilers.

The conventional mechanical producer is not suited to boiler firing, although occasionally there are exceptional conditions that make the use of producer gas desirable. For example, there are three installations of Chapman producers in this country that supply gas successfully for boiler firing.

Progress in England

In England a little more progress has been made than in the United States. There are several small installations in England of Wollaston producers built beneath and integral with boilers designed especially for producer-gas firing. All the producers are hand-operated, and consequently they are limited in size to boilers having less than 2,000 sq.ft. of heating surface. An efficiency of 80 per cent is readily obtained with fuels that formerly gave about 55 per cent efficiency in small boilers. The British government has recently become interested in the project, and further developments are expected soon. The foregoing illustrations have but little bearing upon the suitability of producer gas for large central power stations. However they indicate that a beginning has been made.

Before gas producers can be made suitable for firing large boilers, they will have to be radically changed. Considerable progress has already been made toward that end. The following are the principal improvements that must be made.

1. Producer capacities must be increased to 100 lb. per sq.ft. per hour.
2. Producers must be suitable for location under or within the boiler.
3. Producers must handle slack coal.
4. Producer fire beds must require no hand poking.
5. The present proportion of steam required in the air blast must be greatly reduced.

Producer Under Boiler

If producer gas is to be used efficiently, the heat radiated from the producer, which usually amounts to 5 per cent of the total energy of the fuel used, should be conserved. This can be accomplished by placing the producer under the boiler, which has the added advantage of saving floor space. However, none of the mechanical producers now on the market is suitable for location under a boiler, for they all have agitating and feeding means attached to the producer top and some have revolving walls that render them unsuited to such service. An underfeed producer meets these requirements nicely, and the author believes that a modified form of underfeed producer suitable for boiler firing will be brought out before long.

Underfeed Producers

There are no underfeed gas producers on the market today, but twenty years ago a dozen or more were built and experimented with in the hope of obtaining a suitable gas for gas engines. A few of these experimental producers made gas sufficiently clean, but none made a sufficiently reliable gas for power purposes. The author believes that if the mechanical agitating means that have been developed in recent years had been known to those early experimenters, they would have succeeded in solving their problem and today we would have gas producers for making a clean and uniform gas from bituminous coal, suitable both for use in gas engines and for boiler firing.

In regard to the third requirement—that of utilizing slack coal—the underfeed producer is especially adapted to using fine fuel, and if a capacity of 100 lb. per sq.ft. can be maintained, it should solve the problem.

Heretofore one of the chief difficulties in the underfeed type of producer has

*Abstract of paper presented at the Second National Meeting of the A.S.M.E. Fuels Division, Cleveland, Ohio, September 17 to 20, 1928.

been the lack of "horizontal uniformity" in the density and temperature of the fire bed. The author has recently built an experimental underfeed producer that seems to overcome these shortcomings by providing a horizontally disposed agitating member which strokes the fuel outwardly and packs it against the walls and at the same time breaks up and removes the clinkers. More definite information about this type of producer is reserved until the completion of the experiments now under way.

The complete elimination of hand poking has recently been accomplished in producers that provide water-cooled walls in addition to separate agitation at the top and bottom of the fire bed. The fuel is of course fed in continuously and the ashes removed continuously.

During the last year the author has been able to handle washer refuse under ⅛-in. satisfactorily in a rapidly agitated experimental gas producer. The fuel contained 56 per cent ash and 7½ per cent sulphur. It could not be burned as pulverized coal or in any other conventional way, but it burned with a CO_2 content of 17 per cent and produced a heat of about 2,000 deg. F. when handled in a special gas producer.

If a circular fire bed were provided under a boiler, it would be possible to agitate the fire bed after the manner of a mechanical gas producer. It would then be possible to reduce the excess air to about 5 per cent. The author has experimented with a fire bed of this kind handling a hundred tons of low-grade fuel per day and has obtained 16 to 18 per cent of CO_2 in the stack gases. It is believed that a suitably agitated circular fire bed possesses commercial possibilities for boiler firing when handling otherwise impossible fuels.

The author has been able to meet the final requirement for the efficient utilization of producer gas for boiler firing—that the steam in the air blast be greatly reduced—by operating a producer with water-cooled walls and very thorough agitation. This producer was run without using any steam at all in the air blast, and no serious difficulty was experienced.

Damage Due to Smoke

Excerpts from a paper by H. B. Meller before the recent National Fuels Meeting at Cleveland

BRIEFLY stated, stacks emit in greater or less amounts, depending upon the character of the fuel, the completeness of combustion and the velocities of the resultant products, the following:

1. Carbon, in finely divided particles (lampblack) and in coke.
2. Tar formed by destructive distillation of the fuel, with subsequent condensation of the volatile products.
3. Ash.
4. Ammonia compounds, in variable but comparatively small quantities.
5. Sulphur acids.

Effects on Stone

The products of combustion which are injurious to stone may be divided roughly into two classes: (1) Those which soil and render the buildings unsightly, that is, carbon, tar and ash; (2) those which corrode and in general aid in the destruction and weathering, that is, sulphuric acid, sulphurous acid, hydrogen sulphide, hydrochloric acid, ammonia, the organic acids, etc. The action of carbon and ash, when not associated with tar, is not extremely objectionable, as the simple process of dusting will remove either.

Building stones which do not contain carbonates of calcium and magnesium, such as granite, gneiss and sandstone, are affected but little by the corroding agents derived from combustion. They are readily soiled by the soot when they are finished in the rough, and they are hard to clean.

Stones containing larger or smaller amounts of the carbonates of calcium and magnesium, such as limestone, dolomite, dolomitic limestone, and sandstone with a calcareous cementing material, are susceptible of corrosion by sulphuric acid.

Mortar, on account of its rather porous structure and because it is in process of chemical change for some time after it is placed, is particularly subject to atmospheric acids.

Effect on Metals

The corrosive action of hydrogen sulphide and of ammonia upon most metals is so slight that the injurious effect is hardly more than equivalent to the soiling due to the soot and tar, and the amount of metal lost in cleaning is no more than that which would be lost by the necessary mild abrasion incidental to their removal.

The destruction of the metals by the action of the stronger acids such as sulphuric, is not to be ignored in the construction of buildings in places where the air contains much of this corrosive agent.

Finely divided carbon has the power of occlusion to a high degree, which makes possible the retention of a large amount of corrosive sulphur acids. In addition to the occluded acids carried by the soot, it is continually absorbing more acid from the air. Soot also aids corrosion by retaining moisture.

Ferric oxide, in contact with iron, forms a couple in which the oxide is electro-negative. Therefore, the oxygen is driven toward the metal, accounting for rapid "pitting under the spots of rust." Moreover, the oxide, like all porous substances, absorbs air and in that way tends to localize action.

Zinc is acted upon rapidly by most dilute acids. The purer the zinc, the slower the action.

Tin remains bright in either dry or moist air. It is little affected by the acid-containing air of smoky towns. Where used as a protective coating for iron, corrosion is hastened by galvanic action, especially when part of the coating is worn away. When tin plate is used as a roofing material and the soldering is not perfectly done, corrosion is aided by electrolytic action.

Copper remains unchanged in dry air, but in moist air, especially when the moisture is accompanied by the acids so plentiful in the air of a smoky town, it becomes coated with a greenish basic carbonate sometimes called "verdigris." Dilute hydrochloric and sulphuric acids have but very slight action on copper, which makes it one of the best metals to withstand exposure to town air. However, both copper and brass are particularly sensitive to hydrogen sulphide. Both ammonia and nitric acid, which are constantly present in the air, although in but small quantities, readily attack this metal and many of its alloys.

Lead is not appreciably corroded by the air, although the polished surface becomes dull on exposure because of the formation of oxide.

Effects on Vegetation

It is a matter of general opinion that smoke from mills injures near-by vegetation. The injury done to vegetation by the soot in smoke is probably due chiefly, if not entirely, to the accompanying ash, tar and gases. It is well-established that fumes containing sulphur dioxide and sulphur trioxide do considerable injury to vegetation. Also, certain of the hydrocarbon gases, carbon monoxide, hydrogen sulphide, and carbon disulphide, are injurious.

Influence on Health

Cohen states that an adult breathes about 200 gal. of air in 24 hours, or about 34 lb. in weight, as contrasted with a daily intake of 5½ lb. of liquid and solid food. In other words, the weight of the air inhaled daily is more than six times the weight of the daily consumption of food.

There is no question that the solids and gases in the air due to the burning of fuel have an irritating effect upon the eyes, nose, throat and lungs, tending to aggravate or to cause inflammatory diseases of these organs and to increase susceptibility to certain specific diseases of the respiratory tract. They also enter the gastro-intestinal tract.

Economic Cost

The preventable money loss per capita per annum in a smoky city has been variously estimated to be from ten to twenty dollars. This is made up of extra necessary cost for laundry work, clothes, cleaning, redecorating, repainting, shorter life of certain building materials, damage to merchandise, loss due to improper combustion of fuel, etc.

RECENT PUBLICATIONS

A LABORATORY FURNACE FOR TESTING RESISTANCE OF FIREBRICK TO SLAG EROSION. By Ralph K. Hurst and Chester E. Grigsby. Circular No. 17, Engineering Experiment Station, University of Illinois. Published by the University of Illinois, Urbana, 1928. Paper; 9x6 in.; 18 pages, illustrated. Price, 15 cents.

THE furnace described in this report, the method for its operation and the results will all prove helpful to the engineer engaged in research on boiler furnace refractories. It forms one of the many threads that are gradually being drawn together into a fabric of knowledge concerning the properties and performance of these materials. Its perusal is recommended to all workers in this field.

THE CLASSIFICATION OF COAL. By Samuel W. Parr. Bulletin No. 180. Engineering Experiment Station, University of Illinois. Published by the University of Illinois, Urbana, 1928. Paper; 9x6 in.; 62 pages, 5 charts, 26 tables. Price, 35 cents.

IN THIS day of numerous coal conferences the subject of the classification of coal is assuming more importance to the engineering world. It is therefore timely that this booklet, dealing with Professor Parr's system of classification, should be published. It sketches briefly the history of classifications and deals quite thoroughly with the fundamentals, emphasizing the Parr underlying conception of "unit coal." Twenty-four tables are devoted to classifying most of the coals of the United States. An appendix gives a good bibliography of the subject. The bulletin is authoritative and will be a valued addition to the libraries of engineers and coal technologists.

THE NIAGARA FALLS. By Glen C. Forrester. Published by D. VanNostrand Co., Inc., 8 Warren St., New York City, 1928. Cloth; 9x6 in.; 42 illustrations; 155 pages. Price, $2.50.

NIAGARA FALLS, as they are today, are a work of nature that has taken thousands of years to create. True, as the average person sees them, the Falls are one of the world's greatest natural scenic spectacles. But to know the full picture of their beauty one must be familiar with the story of their origin and the series of events that placed them where they now are, the cutting of the gorge with its many variations, why the gorge and river are here narrow and turbulent, there broad and sullen, how the whirlpool came to be, what the future holds for the Falls and other features.

What a fascinating story! The great glacier comes down and covers Canada and Northern United States. Then winter relents and the onslaught of a milder climate starts to beat back the ice front and the great lakes begin to form with outlets to the Mississippi River. As the ice sheet recedes, other outlets are uncovered and one is across New York State to the Mohawk and Hudson Rivers, and Niagara Falls is born about four miles southeast of Syracuse, N. Y., on what is now known as Clarks Reservation. Further recession of the ice sheet and changes in the elevation of the earth's surface produce a discharge over the Niagara escarpment, the beginning of the present gorge. A long series of events follow that cause at certain periods a large flow down the Niagara River and at others a greatly decreased flow that have given to the gorge and the river its various forms.

Without this story one cannot fully appreciate the beauty of Niagara Falls. The author has presented a story, read from the inscriptions left by nature's process in the rock, that is more fascinating than fiction. To those who would know the beauty of Niagara Falls and the story of its being, this book can be recommended.

THE THERMAL EXPANSION OF FIRECLAY BRICKS. By Albert E. R. Westman. Bulletin No. 181, Engineering Experiment Station, University of Illinois. Published by the University of Illinois, Urbana, 1928. Paper; 9x6 in.; 30 pages. Price, 20 cents.

THIS booklet is a report of an investigation of the thermal expansion and correlated properties of twenty brands of firebrick, carried out with the support of the Utilities Research Committee. The work reported covered the range up to 1,652 deg. F. The test bricks included a wide range, with examples of the most important types manufactured in the United States. The data collected included the pyrometric cone equivalent, absorption, porosity, constitution and thermal expansion.

Analysis of the results obtained indicated:

1. Within the experimental error, the volume percentage of free quartz calculated from the petrographic data were either equal to or less than the volume percentages of free silica calculated from the thermal expansion data, and approximately equal to the volume percentages of free quartz.

2. With a few exceptions, calculations based on the chemical analyses indicated a free silica content high enough to account for the inflections in the thermal expansion curves.

3. With the exception of possibly two of the twenty brands investigated, it was not necessary to postulate the presence of cristobalite set free as a result of the decomposition of kaolinite and subsequent formation of mullite in order to account for the thermal expansion data.

4. For at least eighteen of the brands, the data obtained from thermal expansion measurements, petrographic examination by the powder immersion method, and chemical analysis were in reasonably quantitative agreement with the assumption that the lower inflections in the thermal expansion curves were due to the inversion of cristobalite and the upper inflections to the inversion of quartz, the cristobalite and quartz being originally present in the raw materials as uncombined silica. It could reasonably be expected, therefore, that with more accurate methods for determining percentage expansions due to inversions and more reliable factors for calculating percentages of cristobalite and quartz from such data, useful analyses of fireclay bricks could be made.

FLOW OF BRINE IN PIPES. By Richard E. Gould and Marion Levy. Published by University of Illinois, Urbana, Ill. Paper; 6x9 in.; 24 pages. Price, 15 cents.

IN ALL applications of refrigeration involving the circulation of brine, a knowledge of the magnitude of frictional losses is essential to the economical selection of pipe sizes. The calculation of frictional resistance involves the use of a friction factor, the value of which must be determined for any given set of conditions. A definite relation exists between the friction factor and a ratio known as Reynolds' number. This ratio is a function of the dimensions of the pipe, the average velocity of the fluid, and the density and viscosity of the fluid. The Engineering Experimental Station, University of Illinois, conducted a series of experiments to determine the relation between the friction factor and Reynolds' number when commercial calcium-chloride brine is circulated in standard wrought-iron pipe under the conditions encountered in refrigeration practice. These data have been collected and issued as Bulletin No. 182 under the title, "Flow of Brine in Pipes."

GENERAL RULES AND REGULATIONS PRESCRIBED BY THE BOARD OF SUPERVISING INSPECTORS, GREAT LAKES DIVISION. Published by the Department of Commerce, United States Government Printing Office, Washington, D. C. Paper 6x9 in.; 204 pages.

THIS book contains the rules and regulations for the Great Lakes made by the Board of Supervising Inspectors at the meeting of January, 1928, and by the Executive Committee of the Board at meetings during 1927. Pages 1 to 58 give rules that apply to the construction of boilers to be used on the Great Lakes vessels. This edition also contains a list of all approved vessel equipment. The boiler material in these rules and regulations is of some interest to the engineers of stationary as well as marine plants.

Events and Men in Power's Field

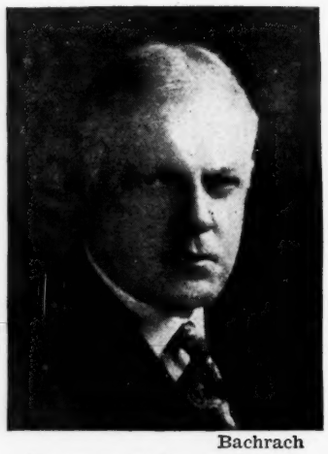
THE EDITORS WILL WELCOME THE CO-OPERATION OF READERS IN REPORTING INTERESTING HAPPENINGS, PERSONAL OR OTHERWISE

Second Bituminous Coal Conference To Present Big Program

One hundred speakers will give papers—Discussion to be from all angles

MORE than a hundred speakers representing twelve countries are listed to present papers at the Second International Conference on Bituminous Coal to be held under the auspices of the Carnegie Institute of Technology in Pittsburgh, Nov. 19 to 24, 1928, according to a preliminary program announced by President Thomas S. Baker.

According to the plans, ten major subjects are listed for discussion, in addition to the addresses of a general nature to be presented by Lord Melchett (Sir Alfred Mond); Georges Claude, eminent French scientist; Prof. Fritz Hofmann,



Bachrach

Dr. T. S. Baker, President Carnegie Institute of Technology

the German scientist who has made synthetic rubber from coal; Dr. F. zur Nedden, of Germany; F. G. Tryon of the United States Bureau of Mines, and others.

As indicated in the list of major topics, the chief purpose of the coming conference will be to present the results of recent studies of coal that have to do with improved methods of utilization and combustion. The list of speakers includes the world's leading authorities on the latest developments in improved utilization of coal as a source of energy and power.

Germany will apparently be represented by the largest delegation with about twenty of her most distinguished scientists and engineers in attendance. France, England and Canada will also be represented by comparatively large numbers of scientists who have been identified with the latest discoveries in coal research. Other countries that will be represented on the program of speakers are Russia, Italy, Japan, Austria, Denmark, Belgium, and Jugoslavia. In addition, delegates have been appointed to represent governments and scientific organizations in Chile, Cuba, Czecho-Slovakia, Norway, Poland, Roumania and Spain.

Approximately 60 of the 103 speakers already listed to participate in the proceedings, the announcement points out, will come from outside of the United States.

The sessions of the conference will be held in Carnegie Music Hall and in various halls of the Carnegie Institute of Technology. Afternoons will be devoted chiefly to sectional meetings, of which there will be as many as five going on simultaneously. Evening features during the week will include a dinner given in honor of the speakers by President Baker Monday night; a public meeting to hear addresses by Dr. E. E. Slosson, Director of Science Service, and Dr. E. W. Smith, of England, on Tuesday night; a smoker on Wednesday night; a banquet for the public on Thursday night; and a public meeting on Friday night to hear an address by George Claude, the eminent French scientist and inventor.

Trips to Pittsburgh District industrial plants and the Carnegie-New York University football game Saturday afternoon, Nov. 24, are also listed as entertainment features.

The program, announced as "subject to change," follows in part:

MONDAY MORNING, NOV. 19

Registration in the foyer of Carnegie Music Hall.

Addresses of welcome by Dr. Thomas S. Baker, president, Carnegie Institute of Technology, and T. P. Gaylord, president, Chamber of Commerce of Pittsburgh; "Coal Problems in Perspective," by Lord Melchett, London, England; "Hydrogenation of Coal" (tentative), by Dr. Carl Krauch.

MONDAY AFTERNOON

Low-Temperature Distillation Section

"The Economics of Low Temperature Coal Treatment," by W. A. Darrah; "Low Temperature Carbonization," by Col. W. A. Bristow; "Low Temperature Carbonization of Coal by the Hayes Process," by F. L. Tenney and M. J. McQuade.

Pulverized-Fuel Section

"A Diesel Engine Using Powdered Coal" (tenative), by Rudolph Pawlikowski; "The Powdered Coal Locomo-

Dr. Ing. M. Dolch

tive of the General Electric Company," by Baurat Walter Kleinow; "Pulverized Fuel Conveying and Firing With Special Reference to Locomotives and Marine Boilers," by Dr. George E. K. Blythe; a paper (title later) by Dr. Ing. I. P. Goosens.

TUESDAY AFTERNOON, NOV. 20

Low-Temperature Distillation Section

"Modern Development in Lignite Carbonization," by Prof. F. P. Kerschbaum; a paper (title later) by T. Ban; "Notes on the Use of Smokeless Pulp Binders for Briqueting," by C. J. Goodwin and G. N. White; "The Influence of Inorganic Materials in Lignite Carbonization," by A. W. Gauger.

Pulverized-Fuel Section

"Thermodynamic Basis of Pulverized Coal Combustion," by Dr. Ing. P. Rosin; "Burning Bituminous Coals in Pulverized Form," by Henry Kreisinger; "Comparison of Stokers and Pulverized Coal," by F. H. Daniels; Discussion, by D. Frank Crawford.

TUESDAY EVENING

"The Fourth Kingdom," by Dr. Edwin E. Slosson; "The Technical Lessons of the World Power Conference, 1928," by Dr. E. W. Smith.

WEDNESDAY AFTERNOON, NOV. 21

Low-Temperature Distillation Section

"The Conversion of Slack Coal and Fines Into Lump Smokeless Fuel—Low-Temperature Coke—By the C.T.G. Process," by Josef Plassmann; "Low-Temperature Distillation of Briquet by Superheated Steam," by Paul Weiss; a paper (title later) by Charles Turner; "Transformation of Fine Bituminous Coal Into Substitutes for Anthracite," by A. Leaute.

Pulverized-Fuel Section

"Adaptation of Pulverized Fuel to Marine Boilers," by C. J. Jefferson and Commander J. J. Broshek, U. S. Navy; a paper (title later) by Prof. L. K. Ramzin.

Dr. J. E. Noeggerath

tive Fuel," by W. L. Robinson; "Carbonized Fuel — How Will It Be Burned?," by M. Alpern; "Black and White Coal in Austria," by Dr. Bartel Granigg.

FRIDAY AFTERNOON

Low-Temperature Distillation Section

"The KSG Low-Temperature Carbonization Plant at New Brunswick, N. J.," by Dr. R. P. Soule; "Principles of Briquetting, Coking and Non-coking Bituminous Coals," by Edgar Stansfield; "Progress Made in the Manufacture of Foundry Coke by a New System of Coal Carbonization," by Julien Pieters; "Heat Transfer in the Coking Process," by Dr. S. P. Burke.

Power and Combustion Section

"Pressure Electrolyser for the Production of Hydrogen and Oxygen at High Pressure Without Compressors, and Its Applications," by Dr. Ing. J. E. Noeggerath; "Some Potential Relations Between Electricity and Coal Utilization," by A. T. Stuart; "The Kilowatt-Hour as a Manufacturing Product," by A. R. Smith; "Fuel Tests and Plant Operation," by Dr. Ing. M. Dolch.

SATURDAY MORNING, NOV. 24

General Session

"The Part of the Catalyst in Coal Processing," by Dr. Hugh S. Taylor; "Coal Consumption as Affected by Increased Efficiency and Other Factors," by Dr. Arthur D. Little; a paper (title later) by Dr. H. C. Parmelee.

Ohio Industrial Plant Pioneers In Use of 1,800-lb. Steam Pressure

A boiler pressure of 1,800 lb. per sq.in. will be used for the first time in commercial practice in the Lockland, Ohio, factory of the Philip Carey Mfg. Co., manufacturers of asbestos and magnesia high pressure steam pipe insulation, of Cleveland, O. This will be the highest steam pressure ever used in America, and the plant will be the largest high pressure steam plant in the world. W. E. S. Dyer, Consulting Engineer, Philadelphia, Pa., will design and have charge of the work.

The high pressure steam generating equipment will be furnished by Combustion Engineering Corporation of New York, and will operate at 1,800 lb. pressure. Integral economizers, water-cooled furnace walls, air preheaters, superheaters and pulverized fuel equipment will comprise these units.

The main generating units will consist of two 5,000 hp. vertical triple expansion, direct connected engines, operating with 1,400 lb. pressure at the throttle, at a temperature of 800 deg. F. and exhausting against 60 lb. back pressure above the atmosphere. To each engine will be direct connected a 3-phase alternator.

All the equipment for this plant will be placed with American manufacturers, except the main engines which will be furnished by A. Borsig of Berlin, Germany.

The operating cycle of this plant will make it one of the most efficient steam plants in the world.

THURSDAY MORNING, NOV. 22

Power and Combustion Section

"A New Method for the Determination of Melting Processes in Ash," by Dr. Karl Bunte; "Removal of Ash and Loss of Carbon from Boiler Furnaces," by Dr. David S. Jacobus; "Clinkering of Coal Ash in Boiler Furnaces," by Thomas G. Estep.

THURSDAY AFTERNOON

Low-Temperature Distillation Section

"Low-Temperature Distillation of Coal by the Carbocite Process," by W. H. Allen, Jr.; "Further Progress of Coal Distillation," by Harald Nielsen; "Low-Temperature Distillation, the British Coal Industry and Oil Supplies," by R. H. Crozier.

Power and Combustion Section

"Clinker Formation" (tentative), by W. D. Langtry and J. H. Kohout; "Coke-Burning Domestic Boiler," by Dr. Charles Brabbee; "Sparking and Smoking Characteristics of Coals," by A. E. Cameron and K. C. Gilbart; "Boiler Furnaces for Bituminous Coal," by Prof. A. G. Christie.

Dr. Karl Bunte

THURSDAY EVENING

Banquet, Hotel Schenley

FRIDAY MORNING, NOV. 23

Power and Combustion Section

A paper (title later) by Eugene McAuliffe and D. C. Buell; "Locomo-

Gear-Testing Machine Invented

The invention of a gear-testing machine that promises to revolutionize the present methods of testing spur-gear machanism has recently been completed by Prof. William H. Rasche, with the assistance of J. F. Downie Smith, both of the mechanical engineering department of the Virginia Polytechnic Institute at Blacksburg, Va.

Engineers Award John Fritz Medal to Herbert Hoover

Recipient to be Presented with Medal at Annual Meeting of Mining Engineers

THE John Fritz Gold Medal, the highest honor bestowed by the engineering profession of this country, has been awarded for 1929 to Herbert Clark Hoover, it has been announced by the Engineering Foundation, in New York City. Alfred D. Flinn, director of the Foundation, is quoted as follows:

"The award was tentatively made a year ago by the John Fritz Medal Board, which is composed of sixteen recent past-presidents of the national societies of Civil, Mining and Metallurgical, Mechanical and Electrical Engineers, having a combined membership of nearly 60,000.

"By this award, which was unanimous, the Board sought to express the high appreciation of Mr. Hoover's professional brethren for his distinguished attainments as an engineer, particularly in mining operations in this and other countries, and his great services as a man to his fellows.

"Notable among his engineering achievements are the successful introduction into other countries of improved American mining methods. His scholarly accomplishments are also worthy of mention, especially his translation into readable English from difficult medieval Latin of Agricola's famous book, 'De Re Metallica.' Mrs. Hoover was associated with him in this enterprise, which occupied 'leisure' hours at one period some years ago."

The citation of the award reads:

"To Herbert Hoover, Engineer, Scholar, Organizer of Relief to War-Stricken Peoples, Public Servant."

The medal, a memorial to the late John Fritz, of Bethlehem, Pa., long a leader in the American iron and steel industry, will be presented to Mr. Hoover at the annual meeting of the American Institute of Mining and Metallurgical Engineers in the third week of February next, in New York City.

During recent years Mr. Hoover has been made an honorary member for life of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Society of Mechanical Engineers.

The sixteen members of the John Fritz Medal Board of Award are:

American Society of Civil Engineers—C. E. Grunsky, Robert Ridgway, George S. Davison, John F. Stevens.

American Institute of Mining and Metallurgical Engineers — William Kelly, J. V. W. Reynders, Samuel A. Taylor, E. DeGolyer.

American Society of Mechanical Engineers—Fred R. Low, D. S. Jacobus, Dexter S. Kimball, Charles M. Schwab.

American Institute of Electrical Engineers—Farley Osgood, M. I. Pupin, C. C. Chesney, Bancroft Gherardi.

This is the twenty-fifth award of the John Fritz Medal. The first was to John Fritz, in 1902, in celebration of his birthday. Notable among the previous medalists are:

Elmer A. Sperry, for the development of the gyroscope; Edward D. Adams, for achievement in the development of hydro-electric power at Niagara Falls; John F. Stevens, for achievement in planning and organizing for the construction of the Panama Canal, building of railroads, and administration of the Chinese Eastern and Siberian Railway during and immediately after the World War; Ambrose Swasey, as a designer and manufacturer of instruments and machines of precision, a builder of great telescopes, and the founder of the Engineering Foundation; Senator Guglielmo Marconi, for the invention of wireless telephony; and General John J. Carty, for achievements in telephone engineering.

Pacific Gas and Electric Adds to Its Steam Stand-by

The growth of the district surrounding San Francisco Bay, Calif., has made it necessary for the Pacific Gas and Electric Company to increase the capacity of its steam stand-by stations. Construction work has been in progress for many months at Station C, Oakland, Calif. Old boilers have been taken out, other apparatus shifted or removed, and the station building itself rebuilt and enlarged. Where there were twelve old boilers, there are now but two, each of sufficient capacity to supply steam for the new 50,000-hp. turbine at full load. These boilers will use oil for fuel.

With the installation of the new turbine and boilers Station C will have a total capacity of 80,000 horsepower.

A.S.M.E. Makes Initial Announcement Of Its Annual Meeting Program

Important changes in schedule of past years—Technical sessions on all five days—Business Meeting to be held in evening.

THE Council of the A.S.M.E. has just announced the program of its annual meeting, to be held on Dec. 3-7 in New York City. The program will contain an important change from the arrangement of previous annual meetings, in that the business meeting of the society will be held on Monday evening, Dec. 3, instead of on Wednesday afternoon, as heretofore. Another important change is the spreading out of the program to cover five days. This comes as the result of an effort to reduce the number of simultaneous sessions by extending them over a longer period.

A full complement of entertainments and excursions will be announced later. A feature, as usual in past years, will be the National Exposition of Power and Mechanical Engineering, more familiarly known as the "Power Show," which will be in progress simultaneously, at the Grand Central Palace. A short statement of the features of this show has already been given in these pages.

Excerpts from the list of papers to be presented, are given below:

MONDAY AFTERNOON, DEC. 3

"Flow in Pipes," by M. D. Aisenstein; "Dredge Pump Pressures and Thrust Loads," by James H. Polhemus and James Healy; "Reasearches on Small Rotary Pumps," by Fritz Aschner and Herr Mattheus.

MONDAY EVENING

8 p.m.—Business Meeting
8:30 p.m.—Open House

TUESDAY MORNING, DEC. 4

"Effect of Alloying Elements Upon the Stability of Steel at Elevated Temperatures," by A. E. White and C. L. Clark; "Balancing Heat and Power in Industrial Plants," by Robt. V. Kleinschmidt; "Some Interesting European Hydraulic Turbine Research," by Blake R. VanLeer; "New Aspects of Maximum Pressure Rise in Closed Conduits," by S. Logan Kerr.

Progress Report of Hydraulic Division.

TUESDAY AFTERNOON

"Material Handling Problems in the Public Utility," by John C. Somers.

Progress Report of Materials Handling Division; Power Test Codes Public Hearing on Water Cooling Equipment.

TUESDAY EVENING

Presidential reception and dance.

WEDNESDAY MORNING, DEC. 5

"Coal Pulverizers," by J. A. London.

Progress Report of the Fuels Division.

"Analysis of Oil-Engine Performance with a View of Rating," by Otto Nonnenbruch.

Progress Report of Oil and Gas Power Division.

WEDNESDAY AFTERNOON

Steam Tables Research Reports.

WEDNESDAY EVENING

Annual Dinner at the Hotel Astor.

THURSDAY MORNING, DEC. 6

"Design of Steam Piping to Care for Expansion," by W. H. Shipman; "Influence of Coal Type on Radiation in Boiler Furnaces," by W. J. Wohlenberg and R. L. Anthony; "Methods of Carrying Peak Loads," by A. G. Christie.

THURSDAY AFTERNOON

Progress Report of Executive Committee on Boiler-Feedwater Studies; Progress Reports on: "Zeolite Softeners Internal Treatment, Priming and Foaming, Sub-Committee No. 3," by C. W. Foulk; "Municipal Water Supplies and the Effect of Trade Wastes in Relation to the Use of Water in Power Plant Practice," by Bernard Siems; "Standard Methods of Water Analysis," by H. Farmer; "Bibliography of Boiler Feedwater Studies," by Geo. A. Stetson; "Flow Measurement," by John L. Hodgson; "Orifice Steam Meter Coefficients," by R. W. Angus; Reports of sub-committees.

FRIDAY MORNING, DEC. 7

Joint Session with A.S.R.E. "Silica Gel," by Geo. E. Hulse; "A Graphical Treatment of Heat Transfer Problems," by Jos. S. Stepanov.

Bay of Fundy Tidal Project Nearer Realization

The gigantic project for the development of tidal power in Passamaquoddy Bay has moved a step forward with the announcement that the Canadian Dexter P. Cooper Company has deposited with the Minister of Public Works at Ottawa and the District Registrar of the Land Registry District of Charlotte County, New Brunswick, a description of the site and the plans of a dam, locks and gates forming a part of the power development proposed to be built in Passamaquoddy Bay at Letite, New Brunswick.

The notice declares that after the expiration of one month from the date of publication, the company will apply to the Minister of Public Works for approval of the site and plans, and for permission to construct the dam, locks and gates, and carry on the development of power. In April last the Cooper Dam bill was passed by the New Brunswick Legislature.

The basic root of the proposition evolved by Dexter P. Cooper, an engineer of New York, is the remarkable rise of the tides in the Bay of Fundy. In Passamaquoddy Bay the rise and fall of the tides is some 28 ft., and by means of dams, bridging various islands, it is proposed to utilize the energy made available by the tides to develop hundreds of thousands of horsepower of electrical energy. The estimated cost of the development is placed at $50,000,000 to $75,000,000, and initial development would range from 400,000 to 500,000 hp. and ultimately reach 700,000 to 800,000 horsepower.

Stoker Manufacturers' Meet

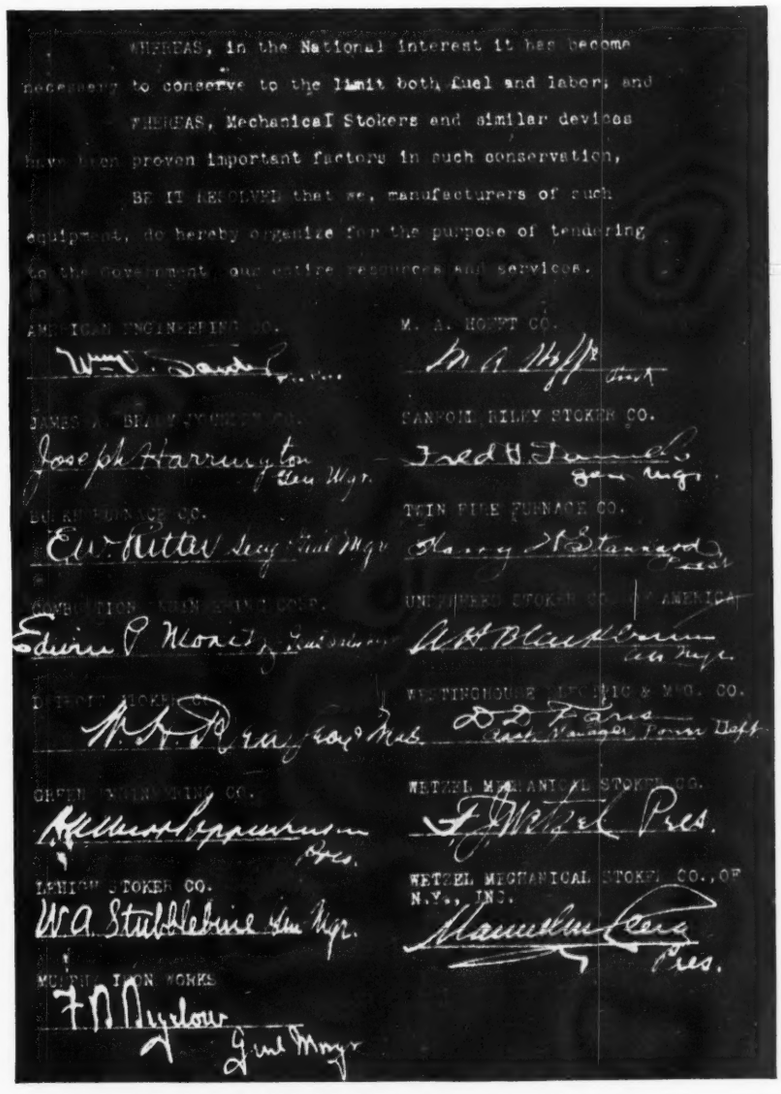
IN HIS opening remarks at the tenth Fall Meeting of the American Stoker Manufacturers' Association, President W. H. Rea, reviewing the progress of the industry during the past decade, exhibited the copy of the articles of association signed by the organizers, and reproduced herewith. The meeting was held at White Sulphur Springs, W. Va., Sept. 22-24.

Mr. Sauter is still one of the vice-presidents of the American Engineering Company, and Mr. Hofft still president of the M. A. Hofft Company.

The stoker business of the Brady Foundry & Machine Company has in the meantime been sold out successively to the Canton Foundry & Machine Company, and to the Riley Stoker Corporation. Joseph Harrington has designed another stoker, made by the Joseph Harrington Company, subsidiary of the Whiting Corporation, of Harvey, Ill.

Fred H. Daniels has, following the death of R. Sanford Riley, become president of the Riley organization, now the Riley Stoker Corporation. E. W. Ritter is still with the Burke Furnace Company; D. D. Faris, who signed for the Westinghouse Electric & Manufacturing Company, is deceased. P. A. Poppenhusen is out of the stoker business; F. J. Wetzel is making occasional stokers at Trenton. The Lehigh Stoker Company is out of business and W. A. Stubblebine is with the Fuller-Lehigh Company. The writer could find out nothing about the Twin Fire Furnace Company, Mr. Stannard, Mr. Llera or his company. Mr. Moritz is now one of the vice-presidents of the Combustion Engineering Corporation; Mr. Blackburn is assistant general manager of the Riley Stoker Corporation. Mr. F. B. Bigelow has gone into the furnace business as president of the Bigelow-Liptak Corporation, and W. H. Rea has become president of the Detroit Stoker Company.

The meeting was exceptionally well attended. The forenoons of Monday and Tuesday, Oct. 22 and 23, were devoted to the reception of reports and round-table discussions. A. F. Strouse,


WHEREAS, in the National interest it has become
necessary to conserve to the limit both fuel and labor, and
WHEREAS, Mechanical Stokers and similar devices
have been proven important factors in such conservation,
BE IT RESOLVED that we, manufacturers of such
equipment, do hereby organize for the purpose of tendering
to the Government our entire resources and services.
AMERICAN ENGINEERING CO.
M. A. HOFFT CO.
CANTON RILEY STOKER CO.
Fred H Daniels Gen Mgr.
TWIN FIRE FURNACE CO.
Harry N Stannard Pres
Edwin P Moritz
WESTINGHOUSE ELECTRIC & MFG. CO.
D D Faris Electric Manager Power Dept
WETZEL MECHANICAL STOKER CO.
F J Wetzel Pres.
LEHIGH STOKER CO.
W A Stubblebine Gen Mgr.
WETZEL MECHANICAL STOKER CO., OF N.Y., INC.
Manuel Llera Pres.
Gen Mgr

Articles of association, signed by the organizers

chairman of the Publicity Committee, presented a new Condensed Catalog, handsomely printed and containing valuable stoker information, of which copies may be had by addressing William V. McAllister, secretary, foot of Walker St., Detroit, Mich.

R. L. Beers led a discussion on "Selection of Coal for the Average Industrial Plant"; F. H. Daniels on "The Small Stoker Situation"; R. B. Mildon, "Sales Problems in Industry"; A. G. Pratt, "Distribution of Selling and Engineering Expenses"; E. Lundgren, "The Repair-Part Business," and J. H. Worker, "Stokers vs. Other Methods of Burning Fuel."

Entertainment included golf and a banquet at which F. R. Low, editor of *Power*, talked upon "The Sun as The Master Stoker."

Charles B. White of Cochrane Company Dead

Charles Bruce White, Chicago representative of the Cochrane Corporation and vice-president and general manager of the Cochrane Engineering Company, died at his home at 6956 Jeffery Ave., Chicago, on Oct. 16, 1928. He was born in Black Rock, Nova Scotia in 1864. His first positions were with the old Edison and Thomson-Houston companies, and about 1891 he had charge of the building of some of the first electric railroads installed in the South.

Charles B. White

At the age of 34 Mr. White came to Chicago to become chief electrician for the Calumet Street Railway. Later he entered the services of the Western Electric Company as a salesman and in 1900 became manager of the Sprague Electric Company's St. Louis branch office. In 1901 Mr. White became associated with A. Sorge, Jr. & Company, who were then representing the Harrison Safety Boiler Works, now the Cochrane Corporation, with which he was associated until Mr. Sorge's death.

Personals

Harold C. Osman, secretary of the Nugent Steel Castings Company, Chicago, Ill., in charge of sales, has been appointed works manager.

Prof. W. Trinks, of the Mechanical Engineering Department, Carnegie Institute of Technology, recently arrived from Germany, where he spent the summer studying fuels-research conditions.

Harold Luther Smith has announced his resignation from the Eastman Kodak Company, of Rochester, N. Y., in order to open an office for the practice of consulting engineering with a specialized service provided for the construction and operation problems of industrial power, heating and refrigerating plants. Mr. Smith's office will be at 381 Ellicott Sq., Buffalo, N. Y.

Coming Conventions

American Institute of Electrical Engineers, annual winter convention, New York City, Jan. 28-Feb. 1; annual summer convention, Swampscott, Mass., June 24-28; F. L. Hutchinson, secretary, 33 West 39th St., New York City.

American Institute of Refrigeration, at Washington, May, 1929. Louis Baron, secretary, 203 West 13th St., New York City.

American Society of Mechanical Engineers, annual meeting, in New York City, Dec. 3 to 7. Calvin Rice, secretary, 33 West 39th St., New York City.

American Society of Refrigerating Engineers, at New York City, Dec. 2-6, 1928. David S. Fiske, secretary, 37 West 39th St., New York City.

American Refractories Institute, fall meeting, New York City, Oct. 24, D. A. Texter, secretary, 2202 Oliver Building, Pittsburgh, Pa.

Master Boiler Makers Association, at Atlanta, Ga., May 21-24. H. D. Vought, secretary, 26 Cortlandt St., New York City.

Midwest Power Conference and Exhibition, at Chicago, Feb. 12-16; G. E. Pfisterer, secretary, 53 West Jackson Blvd., Chicago.

National Association Practical Refrigerating Engineers, annual convention at Louisville, Kentucky, Nov. 20-23; E. H. Fox, secretary, 5707 West Lake St., Chicago, Ill.

National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York City, Dec. 3-8. Address inquiries to the International Exposition Company, Grand Central Palace, New York City.

Second Bituminous Coal Conference will be held at Pittsburgh, Nov. 19-22.

Owen D. Young, chairman of the board of the General Electric Company, recently received the honorary degree of Doctor of Laws from the University of the State of New York, at Albany, N. Y.

Frank R. Fowles, until lately manager of the power and light department, Cumberland County Power & Light Company, Portland, Me., has resigned to join the staff of the Old Colony Corporation, Boston, Mass. In his new position he will be occupied in engineering and financial investigations for this banking organization.

Curtis W. Lehner for the last six years associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently accepted a position as general sales manager of the Southern Ohio Public Service Company, Zanesville, Ohio.

Business Notes

The Consolidation Coal Company, New York City, announces the appointment of W. M. Wilshire as Western sales manager with headquarters in the Bankers Building, Chicago, succeeding M. E. Fleming, who has resigned.

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of Wise & Braisted, General Motors Building, Detroit, Mich. as its District Sales Agent in the State of Michigan.

The Maintenance Company, 449 West 42nd St., New York City, has just issued a four-page bulletin covering briefly certain of its elevator controller and accessory equipment. The bulletin consists of short descriptions and is profusely illustrated.

The Diamond Chain & Manufacturing Company, of Indianapolis, has

Fuel Prices

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	Price per Ton
Navy Standard	New York	$2.35@$2.60
Kanawha	Columbus	1.35@ 1.75
Smokeless	Cincinnati	2.25
Smokeless	Chicago	2.50
S. E. Kentucky	Chicago	1.35@ 1.60
Steam	Pittsburgh	1.65@ 1.80
Gas Slack	Pittsburgh	1.10@ 1.20
Big Seam	Birmingham	1.25@ 1.50
Anthracite (Gross Tons)		
Buckwheat	New York	$2.75@$3.25
Barley	New York	1.25@ 1.75

FUEL OIL

New York—Oct. 25, f.o.b. Bayonne, N. J., 28@34 deg., Baumé, industrial use, tank-car lots, 4¾c. per gal.; 36@40 deg., furnace, tank-car lots, 6¼c. per gal.

St. Louis—Oct. 16, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.37½ per bbl. or 42 gal.; 26@28 deg., $1.42½ per bbl.; 28@30 deg., $1.47½ per bbl.; 30@32 deg., $1.52½ per bbl.; 32@36 deg., gas oil, 4.3c. per gal.; 38@40 deg., 5¼c. per gal.

Pittsburgh—Oct. 16, f.o.b. local refinery, 30@34 deg., fuel oil, 5c. per gal.; 36@40 deg., 5¼c. per gal.

Philadelphia—Oct. 13, 26@30 deg., $1.89@$1.96 per bbl. or 42 gal.; 13@19 deg., $0.95@$1.02 per bbl.; 22 plus. $1.43@$1.50 per bbl.; 27@30 deg., $2.00@$2.07 per bbl.

Cincinnati—Oct. 22, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 5c. per gal.; 26@30 deg., 5½c. per gal.; 30@32 deg., 5.95c. per gal.

Chicago—Oct. 20, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl. or 42 gal.; 22@26 deg., 65c. per bbl.; 26@30 deg., 75c. per bbl.; 30@32 deg., 97½c.@$1 per bbl.

Boston—Oct. 22, tank-car lots, f.o.b. 12@14 deg. Baumé, 4.45c. per gal.; 28@32 deg., 5.6c. per gal.

Dallas—Oct. 20, f.o.b. local refinery, 26@30 deg., $1.15 per bbl. or 42 gallons.

completed arrangements with the I. H. Dexter Company, of Goshen, N. Y. for the manufacture and marketing of the Clark Flexible Coupling.

THE PRAT-DANIEL CORPORATION has recently moved into new headquarters at 183 Madison, Ave., New York City.

TRADE CATALOGS

CENTRIFUGAL PUMPS—"Data 71" is a 12-page bulletin just issued by the Aldrich Pump Company, of Allentown, Pa., dealing with electric motor-driven centrifugal pumping equipment. There are numerous photographs, line drawings and charts, and special attention is given to working out formulas for computing the necessary size of pump and power of motor for each application. A number of performance charts are also included.

INDUSTRIAL HEATING UNITS—The B. F. Sturtevant Company, of Hyde Park, Boston, Mass., has just issued Catalog No. 363 covering the subject of "Tempervane" heating units. The catalog is a most thorough treatise on the applications of these units to many industrial purposes. It is fully illustrated and contains data and tabular information designed to assist in selecting the right equipment for any installation.

PUMPING EQUIPMENT FOR BUILDINGS—Bulletin WP-1003 has just been issued by the Worthington Pump & Machinery Corporation, New York City, describing in a general way the various applications of its equipment to buildings of various kinds. The bulletin, which contains 28 pages, is of a descriptive nature and contains numerous illustrations of installations of pumps, compressors, condensers and oil engines.

STACKS—"Thermix Stacks" is the title given to Catalog No. 14, just issued by the Prat-Daniel Corporation, of New York City. In this publication, covering 24 pages, the Thermix induced draft stack, as used in steam boiler installations, is thoroughly discussed and illustrated.

BUCKET ELEVATORS—A 72-page catalog, No. 465, issued by the Jeffrey Manufacturing Company, of Columbus, Ohio, describes in great detail the many uses of its wide range of bucket elevator equipment. Tables, diagrams, cuts of elevators in action, together with considerable descriptive text, put the product in an interesting light.

ELECTRIC HEAT—The General Electric Company recently issued a bulletin on the subject of electric heating for industrial purposes in its own factories. This publication, GEA-1012, contains 32 pages illustrating and describing the numerous applications of resistance heating devices in large manufacturing plants. The material is divided into 25 items, each one dealing with a different kind of heating problem.

KELVIN BRIDGE—The Leeds & Northrup Company, Philadelphia, Pa., is distributing a new bulletin, No. 434, descriptive of an electrical measuring bridge known as the Students' Kelvin Bridge. The bulletin contains eight pages, in which are contained a description of the bridge, its uses and operation, and mention of the accessories needed. There are several illustrations.

New Plant Construction

COMPILED BY THE MCGRAW-HILL BUSINESS NEWS DEPARTMENT, WHICH IS PREPARED TO FURNISH A MORE COMPLETE DAILY SERVICE TO THOSE WHO WISH IT

Ark., Paris—City, c/o G. A. Hall, Mayor, voted $40,000 bonds for additions and improvements to power house.

Calif., Berkeley—Bd. of Regents of University of California, plans the construction of a power house on university campus. Estimated cost $400,000. Architect not selected.

Calif., Fairfax—Western Management & Finance Co., First National Bank Bldg., San Francisco, is having plans prepared for the construction of a 7 story hotel here. Estimated cost $1,250,000. H. C. Baumann, 251 Kearny St., San Francisco, is architect. L. H. Nishkian, 525 Market St., is engineer.

Calif., Los Angeles—Kaspare Cohn Hospital will receive bids until Nov. 1, for the construction of an 8 story hospital, nurses' home, etc., including boiler room, on Fountain St. Estimated cost $1,500,000. C. Beelman, 1019 Union Bank Bldg., is architect.

Calif., Placerville—El Dorado Irrigation Dist. is having plans prepared for irrigation and power project, to include the construction of earth fill dam, power house, etc. Estimated cost $1,300,000. S. J. Norris, Oroville, is engineer.

Ill., Chicago — H. E. Foster, 18 West Walton Pl., is having plans prepared for an 18 story apartment and club building at 18 West Walton Pl. Estimated cost $1,500,000. B. H. Marshall, 612 Sheridan Rd., Wilmette, Ill., is architect.

Ind., Anderson—Indiana General Service Co., Muncie, plans the construction of an electric sub-station east of city near State Road 67 to furnish reserve power for city of Anderson and 50 per cent of power for Delco-Remy Corp. plants. Estimated cost $600,000. New steel towers from Anderson to Muncie, to cost $300,000.

Ind., Evansville—Coronado Holding Co., c/o Alva Phelps, 306 North 4th St., is having plans prepared for a 10 story apartment building, including steam heating system, etc., on Riverside Dr. Estimated cost $750,000. Bowling & Shank, 1198 Arcade Bldg., St. Louis, Mo., are architects. W. J. Knight & Co., 902 Wainwright Bldg., St. Louis, Mo., are engineers.

Ind., Evansville — Graham-Paige Body Co. awarded contract for the construction of a power plant unit to Hoffman Construction Co. Estimated cost $65,000.

Ind., Evansville — Syndicate, c/o A. Phelps, 306 North 4th St., will build a 12 story office and theatre building, including steam heating system, etc., at Third and Sycamore Sts. Estimated cost $1,500,000. Bowling & Shank, 1198 Arcade Bldg., St. Louis, Mo., are architects. W. J. Knight & Co., 902 Wainwright Bldg., St. Louis, Mo., are engineers.

Ind., Indianapolis — Progress Laundry Co., 428 East Market St., awarded contract for the construction of a boiler plant, to M. M. Andrews, 405 Peoples Bank Bldg. Estimated cost $41,000.

Ia., Davenport — City voted $350,000 bonds for the construction of administration building, gymnasium and heating plant, etc., for high school.

Ia., Hornick—City plans an election Nov. 21 to vote bonds for the construction of a waterworks system including pump house, pumping equipment, etc.

Ia., Sioux City—Morningside College, F. E. Mossman, Pres., is having preliminary plans prepared for the construction of a science hall and library, including steam heating system, etc., on Morningside Ave. Estimated cost $1,000,000.

Kan., Long Island—City plans an election Nov. 5 for waterworks improvement, including pump house, pump, tank on tower, etc. Estimated cost $25,000. Shackley Engineering Co., 800 Graphic Arts Bldg., Kansas City, Mo., is engineer.

Kan., Topeka—Virginian Arms Holding Co., c/o H. M. Guy, 320 West First St., is having plans prepared for the construction of a 10 story apartment, including steam heating system, etc., at 10th and Topeka Aves. Estimated cost $750,000. Bowling & Shank, 1198 Arcade Bldg., St. Louis, Mo., are architects. W. J. Knight & Co., 902 Wainwright Bldg., St. Louis, Mo., are engineers.

Mass., Boston—Boston University, D. L. Marsh, Pres., 688 Boylston St., is having preliminary sketches made for the construction of a group of college buildings, including power plant, etc., at Commonwealth Ave., Granby St. and Charles River Rd. Cram & Ferguson, 248 Boylston St., are architects. Coolidge, Shepley, Bulfinch & Abbott, Ames Bldg., are associate architects.

Mass., Boston—Dept. of Public Buildings, J. P. Englert, Comr., awarded contract for the completion of power house and heating plant at Charles St. jail, to Banspar Construction Co., 9 Castleton St., Jamaica Plain. Estimated cost $59,685.

Mass., Hudson—Light and Power Dept., L. D. Wood, Mgr., plans addition to power plant including equipment. Estimated cost $50,000.

Mass., Lynn—City, T. H. Heath, Comr. Water Supply, City Hall, is having plans prepared for reconstruction of pumping station, including the installation of pumping equipment at Walnut St. Station. H. A. Symonds, 70 State St., Boston, is engineer.

Mich., Battle Creek—City National Bank awarded contract for an 8 story bank and office building on South Jefferson Ave., to Fridstein & Co., West Washington St., Chicago, Ill. Estimated cost $1,000,000. Steam heating system, boilers, elevators, etc., will be installed.

Mich., Detroit—Duns Scotus, Franciscan Fathers, St. Clements Monastery, Vine St., Cincinnati, O., U. Frundt, Chn. Bldg. Committee, will receive bids until Nov. 1, for the construction of a college including steam heating and ventilation systems, boilers, elevators, etc., on Nine Mile Rd. Estimated cost $1,000,000. Wilfred E. Anthony, 131 East 47th St., New York, N. Y., is architect.

Mich., Detroit — Florence Crittenden Home, 583 Elizabeth St., awarded contract for the construction of a maternity home including power house on Woodrow Wilson Ave. to W. E. Wood Co., 1805 Ford Bldg. Estimated cost $500,000.

Mich., L'Anse — Wisconsin-Michigan Power Co., subsidiary of North American Edison Co., 60 Broadway, New York, N. Y., plans the construction of a hydro-electric plant on the Sturgeon River in Baraga county. Estimated cost $3,000,000.

Minn., Minneapolis — Minneapolis Gas Light Co., 14 Ave. S., Minneapolis, c/o F. T. Hulswit, 120 Broadway, New York, N. Y., plans to expend $5,000,000 to $10,000,000 for plant and main extensions within the next two years.

Miss., Hattiesburg—Syndicate, c/o Chamber of Commerce, will soon receive bids for the construction of a 9 story hotel including steam heating system, etc. Estimated cost $500,000. G. D. Barnett, 913 Syndicate Trust Bldg., St. Louis, Mo., is architect.

Mo., St. Louis—Paramount Construction Co., 904 Chestnut St., is having plans prepared for the construction of a 15 story apartment building, including steam heating, refrigeration systems, electric elevators, etc., at 4440 Lindell Blvd.

N. J., Atlantic City—Owner, c/o L. I. Brooks, 65 Madison Ave., New York, N. Y., Archt., is having plans prepared for an 18 story hotel, including steam heating system, etc. Estimated cost $2,000,000.

N. J., Bloomfield—Bloomfield Trust Co., 330 Glenwood Ave., is having sketches made for the construction of a bank and office building, including steam heating system, etc., at Broad St. and Bloomfield Ave. Estimated cost $1,000,000. Uffinger, Foster & Bookwalter, 221 West 57th St., New York, N. Y., are architects.

N. J., Ocean City—American Ice Co., 121 North Broad St., Philadelphia, Pa., is receiving bids for the construction of an ice plant at 12th and Haven Aves. Estimated cost $40,000.

N. Y., New York—Italian Benevolent Institute, S. M. Serrari, will receive bids about Dec. 1 for the construction of a hospital at 136 East 106th St. Estimated cost $2,000,000. A. J. DePace, 151 West 46th St., is architect.

N. Y., New York—Malex Realty Corp., M. D. Greshut, Pres., 522 5th Ave., plans the construction of a 16 story apartment building at 1230 Park Ave. Estimated cost $1,000,000. Gronenberg & Leuchtag, 1385 Broadway, are architects.

N. Y., New York—P. W. Investment Co., 505 5th Ave., awarded contract for a 15 story apartment building at 337 Central Park W., to E. A. Levy Construction Co., 505 5th Ave. Estimated cost $1,000,000. Steam heating and refrigeration systems, elevators, etc., will be installed.

N. Y., New York—Seventy-Five Central Park West Corp. awarded contract for a 15 story apartment building at Central Park W. and 67th St. to F. T. Ley, 321 West 44th St. Estimated cost $1,000,000.

N. Y., New York—Syndicate, c/o Harby, Abrons & Melius, 285 Madison Ave., will build a 40 story hotel at 58th St. and 6th Ave. Estimated cost $5,000,000. Work will be done by separate contracts.

N. Y., Oswego — Hazen & Whipple, 25 West 43rd St., New York, Consult. Engrs., have submitted a report recommending the adoption of electric pumps in proposed enlargement of the pumping facilities of the municipal waterworks. It is planned to increase the pumpage to 13,000,000 gal. of water. Total approximate cost $200,000.

N. Y., Syracuse — L. Fidler, 1108 East Genesee St., will build a 6 story apartment building, including steam heating, ventilation and refrigeration systems, boilers, elevators, etc., at 1030 East Genesee St. Estimated cost $500,000. R. J. West, 242 West Lafayette St., Detroit, Mich., is architect. Work will be done by separate contracts.

O., Cleveland—Cleveland Union Terminal Co., C. L. Bradley, Pres., Terminal Tower, is having plans prepared for the construction of a 14 story department store including steam heating system, etc. at Public Sq. Estimated cost $3,000,000. Graham, Anderson, Probst & White, Railway Exchange Bldg., Chicago, Ill., are architects.

O., Cleveland—Owners Investment Co., W. J. Austin, c/o The Austin Co., 16112 Euclid Ave., Contr., awarded contract for a 16 story hotel at East 105th St. and Carnegie Ave. Estimated cost $1,000,000.

Steam heating, ventilation and refrigeration systems, will be installed.

Okla., Bethany—E. W. Baker & Co., Perrine Bldg., Oklahoma City, plans the construction of a 10 ton raw water ice plant here. Estimated cost $25,000. Private plans.

Okla., Toukawa — City is having preliminary plans prepared for the construction of a municipal electric light plant. Estimated cost to exceed $25,000. V. Wheldon is engineer.

Tenn., Johnson City—Tennessee Eastern Electric Co., c/o Cities Service Co., R. E. Burger, Gen. Mgr., 60 Wall St., New York, plans the construction of a storage dam for hydro-electric development at Junction of Watauga and Holston Rivers, 17 mi. from Johnson City. Initial cost $5,000,000 to $6,000,000.

Tex., Brownsville — Point Isabel Transportation Co., c/o C. R. Tyrell, Pres., will soon receive bids for electrification of 22 miles Rio Grande & Point Isabel R.R., and constructing 30 miles electric railway between Point Isabel and San Benito. Private plans. Power to be supplied from Central Power and Light Co.'s plant.

Tex., Hearne — Atlantic Co. is having plans prepared for the construction of an oil pumping plant near here. Estimated cost including equipment $75,000. Private plans.

B. C., Essondale—Provincial Government, Victoria, will receive bids until Nov. 12, for the construction of a hospital, nurses' home, power house, etc. Estimated cost $1,600,000. H. Whittaker, Victoria, is architect. P. Philip, Dept. of Public Works, Victoria, is engineer.

Ont., Ottawa—Sun Life Assurance Co., Metcalfe St., Montreal, Que., W. Lyle Reid, Sparks and Bank Sts., Ottawa, Ont., Mgr., is having plans prepared for the construction of an office building on Elgin St. Estimated cost $1,000,000. Architect and engineer not selected.

Ont., Toronto—Canada Permanent Mortgage Corp., 14 Toronto St., awarded contract for a 17 story office building at Adelaide and Bay Sts. ,to Anglin Norcross Ltd., Temple Bldg. Estimated cost $1,500,000. Steam heating system, elevators, etc., will be installed.

Ont., Wiarton — W. B. Foshay Co., Walkerton, have acquired the Sauble Falls Light & Power Co. and plans to increase output by 1,000 hp. and build power lines to Hepworth, Oxenden and rural lines. Estimated cost $250,000.

Que., St. Malo—Quebec Power Co. plans additions to gas plant including generating unit with equipment capable of treating 80 ton of coke per day, from which will be produced 2,000,000 cu.ft. of gas. Estimated cost $500,000.

Que., Verdun—Montreal Light, Heat & Power Consolidated, 83 Craig St. W., Montreal, plans the construction of a 60,000 hp. combination outdoor and indoor substation here. Estimated cost $196,000.

Equipment Wanted

Boiler—J. A. Lynch, Pres., Borough of Richmond, Room 108, Borough Hall, Staten Island, N. Y., will receive bids until Oct. 31 for a 40 hp. vertical steam boiler.

Boiler, Generator an Turbines—City of Paris, Ark., will receive bids in November for water tube boiler, generator and turbines for proposed extensions to power plant. Estimated cost $50,000.

Boilers, Pumps, Motors, Transformers, etc. — A. L. Flint, General Purchasing Officer of the Panama Canal, Washington, D. C., will receive bids until Nov. 15 for boilers, pumps, electric motors, transformers, etc.

Generator, Condenser, Pumps, Etc.—Bureau of Yards & Docks, Washington D. C., 1,000 kw. d.c. turbo-generator, surface condenser, motor driven and turbo driven circulating pumps, motor driven condensate pump, switchboard, etc. for Naval Academy, Annapolis, Md.

Pump, Motor, etc.—City of Paso Robles, Calif., J. D. Welborn, Clk., will receive bids until Nov. 5 for one 3 stage Byron Jackson high capacity deep well turbine pump, one 44-74 Byron Jackson built-in type motor base, one 7½ hp. 3 ph. 60 cycle, 1,750 r.p.m. 440 v. automatic starting G. E. type electric motor, built in above head, one CR-7006-D automatic starter, etc., for proposed waterworks improvements.

Pumping Equipment — City of Erick, Okla., pumping equipment for proposed waterworks improvements. Estimated cost $100,000.

Pumping Equipment—City of Waukomis, Okla., pumping equipment, etc., for proposed waterworks improvements. Estimated cost $50,000.

Pumping Equipment—City of Glenwood, Ark., pumping equipment, etc. for proposed waterworks improvements.

Pumps — East Side Levee & Sanitary Dist., 213 Metropolitan Bldg., East St. Louis, Ill., four 54 in. screw pumps with auxiliary equipment for 43 x 75 ft. pumping station and two 36 in. screw pumps with auxiliary equipment for 28 x 30 ft. pumping station in connection with levee system.

Pumps and Engines — City of Gould, Okla., plans to purchase two triplex pumps and engines for proposed waterworks improvements. Estimated cost $59,000.

Industrial Projects

Ind., Connersville—AUTOMOBILE FACTORY—Auburn Auto Co., C. F. Gard, Supt., awarded contract for a 1 story, 80 x 100 ft. factory to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $75,000.

Ia., Des Moines — THRESHING MACHINE FACTORY ADDITION—J. I. Case Threshing Machine Co., c/o James C. Work, 102 8th St., is having preliminary plans prepared for a 4 story, 106 x 130 ft. addition to factory. Estimated cost $80,000. C. V. Johnson, 502 Commonwealth Bldg., is architect.

La., Monroe — PLANT — The Ouachita Iron Works, Inc., have acquired the plant and properties of the Sanders Iron Works and plans extensions and improvements, including foundry, machine shop, boiler room, etc.

Mass., Chester — GRINDING WHEEL FACTORY — Courtland Grinding Wheel Corp., Huntington Rd., awarded contract for a 2 story factory, to A. M. Cowles, 5 Crown St., Westfield. Estimated cost $40,000.

Mich., Detroit — AUTOMOBILE FACTORY—Chrysler Motor Car Co., 341 Massachusetts Ave., Highland Park, will soon award contract for a 4 story, 100 x 125 ft. factory on East Jefferson Ave. here. Estimated cost $100,000. Smith, Hinchman & Grylls, 800 Marquette Bldg., Detroit, are architects.

Mich., Detroit — AUTOMOBILE FACTORY—Hudson Motor Car Co., 12601 East Jefferson Ave., is having plans prepared for a 2 story, 80 x 345 ft. addition to factory on Jefferson Ave. Estimated cost $100,000. A. Kahn, 1000 Marquette Bldg., is architect.

Mich., Flint—SPARK PLUG FACTORY—A. C. Spark Plug Co., Dort Highway, awarded contract for the construction of a 1 story, 72 x 277 and 72 x 225 ft. factory to Realty Construction Co., 502 Industrial Bank Bldg.

Mich., Flint — PIPE WAREHOUSE — Crane Co., 836 South Michigan Ave., Chicago, Ill., is having preliminary plans prepared for the construction of a 1 story, 105 x 150 ft. warehouse for handling various sizes of pipe here. Estimated cost $50,000. Architect not selected.

Mich., Lansing—AUTOMOBILE FACTORY—Olds Motor Car Co., Division St., awarded contract for a 1 story, 100 x 180 ft. addition to automobile factory on Division St. to Reniger Construction Co., 127 North Cedar St. Estimated cost $50,000.

Mo., St. Louis—MATTRESS FACTORY—Sanitary Mattress Co., J. Berkowitz, 1016 North 10th St., will build a 2 story factory 40 x 80 and 76 x 125 ft. factory at 5147 Brown Ave. Work will be done by separate contracts.

Mo., St. Louis — SHOE FACTORY — Samuels Shoe Co., 3443 North Broadway, awarded contract for a 2 story, 150 x 168 ft. factory at Laclade Ave. and Sraah St. to Morrison Construction Co., International Life Bldg.

N. J., Newark—TOOL FACTORY—R. G. Smith Tool & Mfg. Co., 245 N. J. R.R. Ave., is having plans prepared for a 1 story, 100 x 100 ft. factory at 120 Christie St. Estimated cost $40,000. Private plans.

O., Cleveland — GEAR FACTORY — Cloyes Gear Co., R. T. Cloyes, Pres., 1614 Collamer Ave., awarded contract for a 1 and 2 story, 30 x 140 ft. factory on Arabelle Rd., to The Mitzel Co., Keith Bldg. Estimated cost $40,000.

O., Cleveland—AXLE FACTORY—The Eaton Axle Co., East 140th St., awarded contract for a 1 story, 330 x 401 ft. factory at 661 East 140th St., to Crowell & Little Construction Co., Hanna Bldg. Estimated cost $300,000.

O., Cleveland—GEARS AND FORGINGS FACTORY—Gears & Forgings Inc., 3010 Woodhill Rd., awarded contract for a 3 story, 72 x 72 ft. addition to factory to Industrial Construction Co., 308 Euclid Ave. Estimated cost $50,000.

O., Cleveland—BRASS MANUFACTURING PLANT—The Royal Brass Mfg. Co., 1420 East 43rd St., awarded contract for a 1 story, 34 x 132 ft. plant. Estimated cost $40,000.

Wis., Milwaukee — FOUNDRY — Sawyer Steel Casting Co. awarded contract for a 1 story, 48 x 52 ft. foundry and 70 x 70 ft. power house at 37th and Mitchell Sts., to Madison, Christenson & Ingbretson, 1289 National Ave.